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GENERAL PIRMICS CORPORATION

TPL: 2248 26 May 1960

To:

All Holders of Report AZC-27-059

From:

T. M. Wooster - Test Planning

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2 Subject: Instrumentation Configuration Report, E-R&D Summary, Revision B,

dated 15 March 1960

The enclosed document constitutes a major revision to the E-R&D summary report. This revision incorporates all instrumentation changes made since the publication of Revision A and reflects the current instrumentation throughout the (V) text, Illustrations and Tabulations.

Since Revision B supersedes the previous E-RAD Flight documentation, the original report plus Revision A should be removed from the 3 ring binder originally supplied and hevision B inserted.

The instrumentation configuration report for missile 38 has been included in this package and should be inserted in the back of the E-R&D summary.

Disposition of the replaced pages should be in accordance with existing security regulations.

Note that Revision B is now "Flight Missiles" only and that all 3 Series Captive instrumentation is documented in Report AZB-27-015. E Series Operational ! strumentation (IRSS) has also been removed from Revision D and is covered in Report 13C-27-068.

TW:WSB:prg

Distribution List Report AZC-27-059 Instrumentation Planning

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GENERAL DYNAMICS CORPORATION

TPL: 2347 17 August 1960

To:

All Holders of Report AZC-27-059

From:

T. M. Wooster - Test Planning

ASTRONAUTICS AUG 19 1960

Subject:

Instrumentation Configuration Report E (R&D) Summary,

Revision C, dated 13 July 1960

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The enclosed pages constitute a minor revision to the E-R&D Summary Report. This revision incorporates all instrumentation changes made since the publication of the original report and reflects the current configuration in the two composites.

It is recommended that the enclosed pages be physically incorporated into Report AZC-27-059, replacing the superseded sections in order that holders of the document may have a current and complete instrumentation configuration document for the E-R&D series under a single cover.

Disposition of the replaced pages should be in accordance with existing security regulations.

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SUMMARY (FLIGHT MISSILES)

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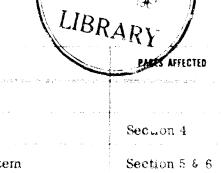
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PREPARED BY Instrumentation Planning

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			E Series Composite By Problem Area	Section 7 & 8

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INSTRUMENTATION CONFIGURATION SUMMARY (FLIGHT MISSILES) E SERIES

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PAGE NO.

15 MAY 1961

FOREWORD

This report describes the instrumentation provided for the Series E Atlas Flight Test Program. Instrumentation contained in this report comprise General Dynamics/Astronautics and associated contractor data requirements as evaluated 15 May 1961.

Information contained in this report will be used by Instrumentation, Design, Operations, and Data Reduction Groups to determine instrumentation, data handling, and data reduction requirements. Measurement modification will either originate in the Instrumentation Planning Group or will be submitted as a recommendation to this group.

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SUMMARY

This report describes the instrumentation presently planned to support the Atlas Series E R&D Flight Test Program. This instrumentation has resulted from a detailed analysis of missile systems design, program test objectives, and test operations considerations.

Section 3 of this report describes the measurements to be made for evaluation/malfunction analyses of the Atlas vehicles. Included are reasons for making the measurements, descriptions of unusual instrumentation techniques utilized and a summary of what will be learned from the data obtained.

The methods to be utilized in acquiring test data are detailed in Section 4. The telemetry, landline, and tracking systems planned for the Series E program are described with reference to hardware utilized, principle of operation, capacity and accuracy. Included also is a summary of the methods of acquiring supporting data.

Section 5 of this report presents a summary of the data handling, processing, and reporting plan for the program. Operating instrumentation required to conduct missile checkout, pre-count, and countdown operations is discussed in Section 6.

In order to clarify the measurements, instrumentation functional schematics have been included in Section 7 of this report. (See List of Illustrations.)

A complete summary of the Series E Flight Test Program internal instrumentation and Ground Support Equipment (GSE) instrumentation is shown in Section 8. The test objectives for these flight missiles along with their associated instrumentation may be found in Section 9.

Specific instrumentation configuration and associated parameters for the Individual Series E R&D missiles will be described in supplements which are to be filed in the back of this summary report. (Note 3-E is already included.) Tabulations of the tracking and support darequirements are shown in Section 10. Official Convair requirements have been submitted to AMR through BMD in report AE60-0345.

In order to clarify the format and abbreviations utilized in the IBM tabulations, an instrumentation tabulation code key is included as Section 11.

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SUMMARY OF TELEMETERED MEASUREMENTS TYPICAL SERIES E MISSILE (3-E)

		4.1				MEA				<u></u>				 .				
MISSILE SYSTEM INSTRUMENTED	ACCELERATION	ROTATION RATE	CURRENT	DEFLECTION	POWER	POSITION	INTENSITY	VELOCITY	VIBRATION	PRESSURE	FREQUENCY	RATE	TEMPERATURE	VOLTAGE	TIME	DISCRETE POSITION	TOTAL	
AIRFRAME							2						7				9	
RANGE SAFETY														2		1	3]]
ELECTRICAL											1			3			4	
PNEUMATICS										8			4				12	
MOD III BEACONS			1		1									2			4	
HYDRAULICS										2							2	
GUIDANCE (INERTIAL)	6			4		5		3	6	1			5	11	2	8	51	
MISCELLANEOUS				1												7	8] <
PROPULSION	2	3		2						18			5			3	33	
FLIGHT CONTROL				13								3				1	17	
TELEMETERING													2				2	
PROPELLANT UTILIZATION										2				1			3	
PAYLOAD																1	1	
AZUSA TRANS- PONDER					2												2	
1'OTAL	8	3	1	20	3	5	2	3	6	31	1	3	23	19	2	21	151	(

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SUMMARY OF LANDLINE MEASUREMENTS TYPICAL SERIES E MISSILE (3-E)

	TYPE OF MEASUREMENT													$\ $
MISSILE SYSTEM INSTRUMENTED		ACCELERATION	CURRENT	DEFLECTION	POSITION	VELOCITY	PRESSURE	STRAIN	TEMPERATURE	VOLTAGE	TIME	DISCRETE POSITION	TOTAL	
PNEUMATICS							4						4	
GUIDANCE (INERTIAL)		6	3	3	5	3				1	1	6	28	
LAUNCHER				2				2	4				8	
MISCELLANEOUS												1	1	1
FACILITIES & SITE							3		2			5	10	
PROPULSION				1			8		7			10	26	
FLIGHT CONTROL SYSTEM										17		1	18	
PROPELLANT UTILIZATION										1		8	9	
TOTAL		6	3	6	5	3	15	2	13	19	1	31	104	

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SUMMARY OF RECENT SIGNIFICANT INSTRUMENTATION CHANGES

The following text and schematics have been added as a supplement to the original report.

The revised tab runs should be inserted in their proper place in the body of the report. These tab runs incorporate the instrumentation that has been added or revised as a result of the added tasks and modifications to the systems presently installed in the latter Series E missiles.

I. AERODYNAMIC HEATING

- A. Instrumentation has been located on the antenna support struts to obtain data for the study of Aerodynamic heating effects on the struts and the laminated insulation protecting them. New design has eliminated the Azusa antenna strut. Due to similarity of design, measurements A978T and A979T are located on General Electric Antenna struts. The Azusa measurements A680T and A681T have been deleted.
- B. To insure that the temperature in the main and the clamshell fairings are not too severe, the components have been wrapped with insulation. Additional data to determine if continued wrapping is necessary will be provided by measurements A2T, A19T, A20T and A21T.
- C. Calculations indicate that temperatures caused on the missile structure by the piggyback pod may cause the structure to be marginal. Temperature measurements (A41T, A42T, A43T, A44T, A45T) are needed at the predicted hot spots to evaluate the problem and determine the effectiveness of the thermal coating (Dynatherm). In conjunction with this study, aerodynamics temperature measurements (A52T, A53T, A54T, A55T) are placed near the AFSWC pod, and (A46T, (A47T, A48T, A49T) near the ADF fairing.
- D. To obtain data on the performance of the missileborne portion of the ground pod cooling system the following landline instrumentation has been added: 11 temperature measurements on the ROTARY INVERTER in the B2 POD, QUADRANT 2; 16 temperature measurements on the GE PULSE BEACON in the B1 POD, QUADRANT 4; 8 temperature measurements on the NO. 2 TELEMETRY PACKAGE, B1 POD QUADRANT 4; 10 pressure measurements on PITOT TUBES in the ducts from the mobile air conditioning unit to the missile, 5 temperature measurements on PORTABLE THERMOMETERS, and 2 pressure measurements on PORTABLE MANOMETERS.

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E. In order to measure the ambient temperature of the ARMA pod, landline measurement N1932T has been added on all missiles flown from complexes 11 and 13.

II. AFSWC POD LANYARD

The camera, N1517N, AFSWC POD LANYARD will be set up to view the lanyard which pulls out of the AFSWC pod at liftoff. This coverage is desired to check any tendency of the pod timer lanyard to snag or hang up on any missile pertuberance.

III. ENGINE ENVIRONMENT

Data from three (3) temperature measurements (A933T, A934T, A935T) taken on the AEDC AFT SHIELD CALORIMETER will reveal total heating rates, relative heating intensity of a hot spot between engines, the relative heating intensities of the outer and inner heat shield peripheries, and model scaling laws applicable to recirculation predictions.

IV. STRIPPED MISSILE STUDY

Three R&D Series E&F missiles have been stripped to approximate operational missile weight. Primary mission of these three vehicles is to demonstrate maximum range flight with a Mark 4, Mod 1 re-entry vehicle.

In order to meet this stripped weight configuration telemetry packages No. 2 and No. 3 have been deleted. In order to provide sufficient channel space on the remaining telemetry package the guidance instrumentation was reduced to correspond to that flown on operational vehicles. The Arma R&D Analog Signal Converter (ASC) will be used and all unused data signal leads will be tied back at the telemeter input.

V. PROPULSION

A. Due to the free launch configuration, the E series missile lifts off the pad when the engine thrust reaches approximately 60% of nominal and the engine start sequence is still incomplete. In order to obtain continuous, high frequency response data during the entire engine start sequence for failure and performance analysis purpose, a trailing wire instrumentation umbilical will be provided. The trailing umbilical will be attached to the missile for at least ten feet of

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vertical travel and supply data for a minimum of three seconds after engine start. The data will be recorded on a FM magnetic tape to allow the highest frequency response and most comprehensive data reduction methods to be utilized. The selected measurements that will be transmitted via the trailing umbilical are:

Accelerometers on booster (P1208O, P1209O) and sustainer (P1206O) engine LOX domes detect excessive engine vibration caused by combustion instability, propellant surges, and other transient phenomena. Pressure instrumentation in the booster engine LOX (P1001P, P1003P) and fuel (P1002P, P1004P) turbopump inlets determine satisfaction of engine interface requirements, propellant ducting integrity and turbopump performance. Booster high pressure propellant ducting integrity, main propellant valve peration, turbopump action, and engine transient behavior are detected by pressure measurements in the booster LOX (P1091P, P1092P) and fuel (P1093P, P1094P) injection manifold.

- A. The booster engine LOX pump inlet temperature (P1054T) will be monitored by regular landline system instrumentation during launch countdown. This information will assure that turbopump starting NPSH requirements are satisfied and determine the adequacy of the LOX topping and slug systems.
- B. Four (4) sequence measurements (P1225X, ENGINE CONTROL READY, P1229X, LOX HIGH TOPPING, P1230X, LOX LOW TOPPING, and P1231X, LOX 100% SLUG COM) used for flight test and systems validation will provide time-sequence of operation during ground checkout.

VI. PROPELLANT UTILIZATION

A. The Acoustica propellant utilization system using a CA 108 (5 card) computer assembly will be operated closed loop (sustainer main fuel valve controlled by the computer assembly). Six basic measurements are used to indicate system operation. These measurements and the functions of each are described below:

U132X, Acoustica sensor station counter output determines the adequacy of operation of the blockhouse generated reset signal and also determines to which sensor pair (corresponding stations in each propellant tank) the computer is connected.

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1)

U112V, Error counter output. This measurement is required to determine whether the PU computer responded properly to the error time measured by the computer monostables and that the error sense relay in the computer functioned according to error sense (LO $_2$ or fuel rich). This measurement also provides a check on operation of the digital to analog converter.

U113V, servo feedback voltage, is used to determine whether the PU system moved the PU valve to the correct valve angle.

U135X, Acoustica sensor signal, represents the output of two monostable multivibrators which are triggered by the uncovering of the acoustical sensors. The signal can exist at any one of four states dependent upon activation of either or both monostable multivibrators or deactivation of either. This measurement will furnish information on discrete tank levels versus time, opening and closing time of oscillator to counter gate, and desired magnitude and sense of the error command signal.

U133X, Acoustica Schmitt trigger output. This measurement furnishes time correlation between the oscillator and monostable multivibrator outputs and monitors the system ability to prevent transients of less than 100 milliseconds from triggering the computer.

U134X, Acoustica time-shared oscillator output. This measurement, in conjunction with U135X, determines if any spurious sensor uncoverings occurred.

B. Information will be provided by measurement U107C PU SV AMP OUT, which will separate the electronic and hydraulic system with respect to failure analysis of the propellant utilization system.

In order to enable the launch crew to be assured of the PU valve operation prior to propulsion start, a redline measurement (U1107C) has been added for those missiles which utilize the Astronautics PU system. This measurement indicates whether or not current is flowing in the PU servo-control loop and allows sufficient time to abort if PU current is not present.

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VII. HYDRAULIC SYSTEM

A. Instrumentation added will provide data for evaluation of the performance of the airborne hydraulic system. Measurements H130P, S HYD PUMP DISCH, and H185P, S HYD PUMP INLET will determine the proper operation of the sustainer hydraulic pump. H191P, HI PR TO MANIFOLD, and H212P, VERNIER RETURN in conjunction with H185P will give a profile of the high pressure portion of the system. The low pressure is monitored by H140P, SUS/VERN HYD PR. Pressure surges in the sustainer system during ground to airborne switchover are detected by H1360P, HYD SUSTAINER RETURN.

Proper operation of the low pressure portion of the booster hydraulic system is determined by H224P, B HYD SYS LO PRESS, high pressure operation by H33P, B1 HYD ACCUMULATOR.

- B. To determine that the hydraulic fluid is evacuated in the commit sequence, measurements H1187X, BSTR OIL EVACUATION and H1188X, SUST OIL EVACUATION are taken.
- C. Due to a flight failure, further instrumentation is required for the hydraulic and propellant utilization systems. Therefore (H414P) PU VLV CLS SERVO has been added.
- D. In order to determine whether or not the hydraulic fluid remains within specified temperature limits, measurements of the booster (H1T) and sustainer (H131T) pump discharge will be taken.

VIII. INTERMEDIATE BULKHEAD INSULATION REMOVAL STUDY

The removal of the insulation from the intermediate bulkheads on certain flights will result in additional heat being transferred into the LOX tank. In order to obtain information on the amount of heat transferred into the liquid oxygen, temperature stratification within the tank, and the quantity of gaseous oxygen present in the tank, a series of temperature measurements (F97T, F371T, F773T through F779T) (F374T through F377T, F780T through F783T, F786T) will be installed in and on the LOX tank. A temperature measurement at the LOX tank helium inlet (F771T) will establish helium inlet conditions and in conjunction with an orifice type flowmeter consisting of differential pressure (F1147P) and ambient temperature (F146T) and pressure (F6P) instrumentation in the LOX tank helium pressurization line, will determine the amount of helium used to pressurize the LCX tank.

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Due to the heat lost from the fuel tank into the LOX tank, a greater quantity of helium is required to pressurize the fuel tank. The amount of helium going to the fuel tank will be measured by an orifice type flowmeter which utilizes differential pressure (F34P) and ambient temperature (F17T) and pressure (F212F) measurements in the fuel tank helium pressurization line.

The object of this insulation removal study is to establish the quantity of gaseous oxygen and helium used to pressurize the main propellant tanks. This information will determine the desirability of permanently removing the insulation bulkhead on all future Atlas flight articles to optimize flight trajectories.

To simplify design tasks, release procedures and avoid confusion with similar measurement numbers assigned for the LOX ullage study, F92T, F93T, F94T, F95T, and F99T have been deleted.

IX. PNEUMATIC REGULATOR STUDY

Fourteen (14) measurements are added as part of the E series pneumatic study. The purpose of these measurements is to obtain accurate inflight data of vibrational input at the regulator mounting base and on the regulator. This data will be used to supplement laboratory testing to establish vibrational specification

The transcocers are Gulton KA-1000 G systems, composed of an A-395 TMU-1 accelerometer and a FT-521U amplifier. These are a piezoelectric type with a nominal sensitivity of 833 MV/G. The amplifier gain is variable from 5 to 50. The complete system sensitivity is flut to ± 3% over the temperature range of -50 to +185 DGF, and has a cross-aris sensitivity of less than 5%. The ranges are plus to minus 30 G's with frequency response to 1200 CPS. The telemetering is being accomplished by the "burst" technique over channel C. The "burst technique" is implemented by connecting a series of commutator persitogether. Channel C is commutated at 1/3 rps and the output from each accelerometer is monitored for approximately 1 second every 8 seconds.

X. FLIGHT CONTROL

A. Autopilot

These measurements are being made to checkout and valid de the satisfactory condition of the Autopilot Programmer prior to Jaunea. Inadvertent switching

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occurred on similar packages during D "AIG" flight testing. Recorded data of the checkout will provide information on timing and individual peculiarities of the package.

MEAS NO.	DESCRIPTION	
ADD		
S1370X	STAGING DISCRETE	
S1371X	BOOSTER JETTISON COMMAND	
S1372X	PRESSURIZE VERNER HYDRAULIC SYSTEM COMMAND	
S1373X	BOOSTER ENGINES CUTOFF COMMAND	
S1374X	SUSTAINER ENGINE CUTOFF COMMAND	
S1375X	VERNIER SOLO HYDRAULIC PRESSURIZATION SYSTEM	
	BACK-UP	
S1376X	VERNIER ENGINES CUTOFF COMMAND	
S1377X	EJECT RE ENTRY VEHICLE COMMAND	
S1378X	RE-ENTRY VEHICLE JETTISON COMMAND	

B. Instrumentation of the high power switches is required to isolate and correctly diagnose possible failures of the programmer, electrical harness and pyrotechnic squibs. To obtain this data the following sequence measurements have been wided:

FIRE RETROROCKETS COMMAND

S373X	BOOSTER CUTOFF
S374X	SUSTALLER CUTOFF
3376X	VERNIER CUTOFF
S379X	FIRE RETROROCKETS
539±X	THOR RETROROCKET COMMAND

S1379X

GCA

- C. An accelerometer-switch being flown open loop initiates a backup booster staging command. To further test and achieve confidence in this unit two telemetry measurements (S359X) BOOSTER STAGING B/U and (S385V) ACCEL 490 CYCLE CONT have been added.
- D. S151X TANK FRAG DESTRUCT. This measurement has been added to establish via telemetry that the destruct signal has actually been sent by the programmer.

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- E. The roll program is accomplished by ARMA signal, which function is monitored Ly measurement 1529V. Therefore measurement S1049V, PROGRAMMER ROLL SIGNAL has been deleted.
- F. M79A, MISSILE AXIAL ACCELERATION. A fine range measurement (plus to minus 0.5G's) is being made to provide information on small changes in acceleration caused by sustainer thrust decay, vernier engine performance, cutoff characteristics, R/V unlatch and retrorocket firing. The transducer is a Donner force balance servo system, transistorized, internally biased, requires a 28 VDC power supply and has a 0-5 volt output.

XI. GUIDANCE

11607Q, ASC HETRODYNE FREQ and I1528V, YAW STEERING SIG are effective at AMR only for missiles launched from complex 11. I1601V, 400 CPS REFERENCE and I1606V, COMPUTER RESET are effective on the Series E missiles launched from other complexes. COMPUTER RESET monitors the voltage which permits the computer to accept accelerometer signals and starts the sequence of computer operation; it is a convenient time reference to be used with measurement I1510W, ELAPSED TIME.

XII. TRACKING

D

- A. Light data on Missiles 9E and 13E indicate that vibration levels on the beem antenna and the rate beacon-impact predictor were considerably higher than expected. Measurements located on different sections of the General Electric equipment to permit more extensive analysis of the problem are (G1960) PB-IP RADIAL, (G5950) PB WAVEGUIDE RAD, and (G5870) POD WAVEGUIDE.
- B. Due to the complexity in making and calibrating measurement ZCE, KLYSTRON POWER OUTPUT, it has been deleted.

XIII. DECOY (RESEARCH POD)

General

This pod will be used to test various research type decoys, especially those of a size or shape which cannot be evaluated with the R&D decoy pods. Attachment fittings present being built into Atlas missiles will be utilized in mounting the research pod.

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A. System Description

The research pod consists of a single launch tube 12" in diameter and 60" long mounted through a gimbal system to a base support structure. The forward end of the launch tube is protected by an aerodynamic fairing which also contains the major components of the pod electrical system. The decoy weight which may be accommodated is limited principally by the maximum recoil force transmitted to the missile attachment weldments. Thus, decoys somewhat heavier than those considered in the present design may be used if low ejection speeds can be tolerated.

The aerodynamic fairing is made in two parts. The lower part is a structural member transmitting aerodynamic and ejection loads into the missile. The upper portion of the fairing is a nonstructural member and is ejected from the pod prior to launch tube orientation which permits rear hemispherical orientation.

B. Operation

The sequence of pod operation events is as follows:

- 1. After proper completion of the missile boost and sustainer acceleration, the system is placed in an armed condition.
- 2. The upper portion of the fairing is ejected with a squib actuated device and the launch tube latch is released enabling the launch tube to orient.
- 3. The launch tube orients to the correct polar and azimuth location by either an electric motor actuator or by a gimbal spring.
- 4. After sufficient time has elapsed to insure correct orientation, the signal to fire the ejection device is given.
- 5. The canister is irreed from its connection to the raunch tube and is ejected. For moderate ejection velocities of about 30 to 40 ft/sec, an explosive actuated ejection device will be used. For low velocities a spring ejection system, which is released by the firing of a squib, will be used.

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C. Instrumentation

- 1. Measurements Y103X, Y104X, Y105X and Y106X, will be made to monitor operation of the arming and timing unit
- 2. Y150X, FAIRING RELEASE, Y155X, TUBE UNLATCH, Y151X, UNLATCH SIGNAL, Y152X, MOTOR START, and Y153X, EJECT SIGNAL will be determined by monitoring various relays in the Junction Box.
- 3. Y154X, LAUNCH TUBE ORIENTATION will be picked up by a potentiometer connected to the orientation mechanism.
- 4. Y141X, EJECT SURE and Y102L, EJECTION VELOCITY will be monitored by use of microswitches mounted in the launch tube.
- 5. To study pod heating profiles during the max Q and max heating portions of flight Y158T, TEMP B IN FAIRING, Y159T, TEMP C IN FAIRING, Y160T, TEMP D IN FAIRING and Y161T, TEMP A IN FAIRING have been added.

XIV. AEROSPACE GROUND EQUIPMENT

A. Four measurements have been added to determine that proper sequencing of the LOX slug transfer values occurs:

MEAS NO.	DESCRIPTION:	
ADD		
N1356X	SLG CHG LO2 LOW LEVEL	
N1932X	${ m LO}_2$ TPNG VLV CLOSED	
N1933X	LO_2 TPNG VLV CLOSED	
N1979X	PRESS VLV CLOSED	

B. Because there is no further test data needed on LOX transfer us at AMR N1314T and N1338X have been deleted.

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INTRODUCTION

GENERAL

This report describes the instrumentation of SM-65-E Series R&D (Atlas) missiles to be flight tested at the Air Force Missile Test Center (AFMTC), Cape Canaveral, Florida. All launchings will be made from Launch Complexes No. 11 and No. 13.

In general, the Series E R&D missiles are similar to the Series D (AIG) R&D missiles flown during the latter portion of the series D program. Primary innovations on series E missiles include the MA-3 rocket engine system, redesigned propellant feed ducting, sustainer engine gimbaling at staging, free-launch (no holddown), Lot IV inertial guidance, redesigned propellant level control system, new pneumatic regulators, redesigned fuel and LO₂ staging valves, and structural changes required to accommodate these differences. These changes and the various series E systems are described in detail in the Flight Test Program, SM-55E Series Missiles, Convair Report AZC-27-005.

Milestones to be accomplished during the program are the initial evaluation of the Series E R&D basic configuration, demonstration of operational capability and reliability, and special flights for evaluation of broader operational capabilities.

The purpose of the series E flight test program is to provide data for the accomplishment of the following six missions:

- 1. Basic Series E missile evaluation.
- 2. Circular error of probability evaluation.
- 3. Maximum range inertial guidance evaluation.
- 4. Maximum range weapon system demonstration.
- 5. Weapon system reliability evaluation.

Details pertaining to these six basic missions are described in the Flight Test Program, SM-65E Series Missiles, Convair Report AZC-27-005. Detailed objectives for each of the series E R&D flight missiles will be described in the Flight Test Plan issued each individual missile.

II. FLIGHT TEST PROGRAM INSTRUMENTATION PHILOSOPHY

The selection of instrumentation to support the flight testing of the Atlas vehicles has been approached primarily as a system problem. Its purpose is to determine whether the various vehicle systems as a whole operate adequately in the flight environment.

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in general then the flight that instrumentation is not designed to check individual component design adequacy. (This is accomplished in component and systems testing.) Should a failure occur in flight it may be necessary to resort to laboratory or captive testing to determine the cause.

III. DEFINITION OF TEST INSTRUMENTATION AND DATA CATEGORIES

Evaluative Instrumentation - that instrumentation required to support test objectives.

Operating Instrumentation - consisting of redline and design limit measurements which are required by site personnel to monitor critical parameters during check-out, precount, and countdown operations.

Failure Analysis Instrumentation - any of the Series E program measurements may, in the event of particular types of failure, become useful in failure analysis. Therefore measurements not specifically assigned to the above two categories are automatically classified as failure analysis instrumentation.

<u>Telemetered Data</u> - intelligence which will be sensed by elements on the vehicle and transmitted by RF link to a ground receiving station for recording.

Landline Data - intelligence which will be sensed by elements on both the missile and ground support equipment and transmitted over a direct wire system to recorders.

Range Data - intelligence which is requested from the missile test range authorities. The actual method of acquisition is left to the discretion of the range authorities.

Internal Data - defined as that data which is generated by measuring instruments aboard the vehicle being tested. Included in this category are all measurements acquired to evaluate missile system performance; all measurements acquired to determine the environment in which the missile system operates, operating measurements, and general malfunction analysis measurements.

Tracking Data - defined as that data which is acquired by systems or instruments located on the ground and permits determination of position and velocity of the vehicle. Included in this category are: fixed camera, theodolite, radar, Azusa, Minitrack, Trace, and radio telescope, etc.

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Support Data - defined as that data which cannot be classified as internal or tracking but is of the nature which supplements internal and/or tracking data. Included in this category are all data gathered to determine the performance of the ground support equipment and site facilities, weather, time, still photographs, movies, launch coordinates, chemical analysis of fuels, computer outputs, etc.

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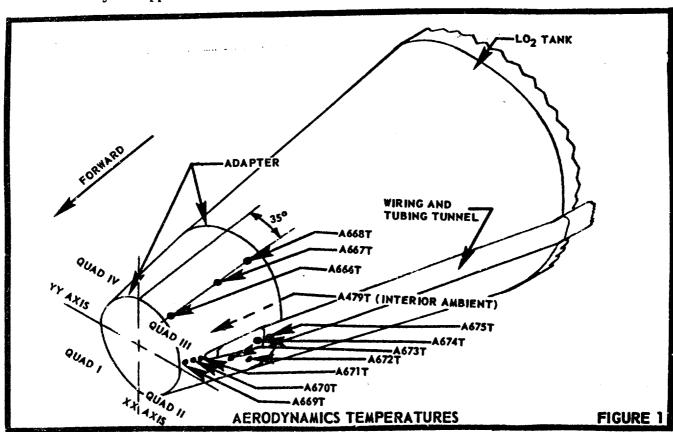
DESCRIPTION OF MISSILE AND GSE INSTRUMENTATION

I. AIRFRAME INSTRUMENTATION

Airframe instrumentation includes measurements which will yield data on airframe separations (stagings), and general environmental conditions. Particular areas of interest include temperature, vibration, staging mechanism operation, and fire detection.

A. Temperature Measurements

As of this date temperature measurements are planned for studies of guidance equipment, engine area and LO₂ tank interior. In addition, because of extensive changes of the "E" series from the "D" series; a broad temperature survey has been proposed. An ECP (Engineering Change Proposal) has been submitted to the Air Force covering this survey. The following discussions cover both existing and proposed temperature measurements. The tabulations in this report reflect only the approved measurements.

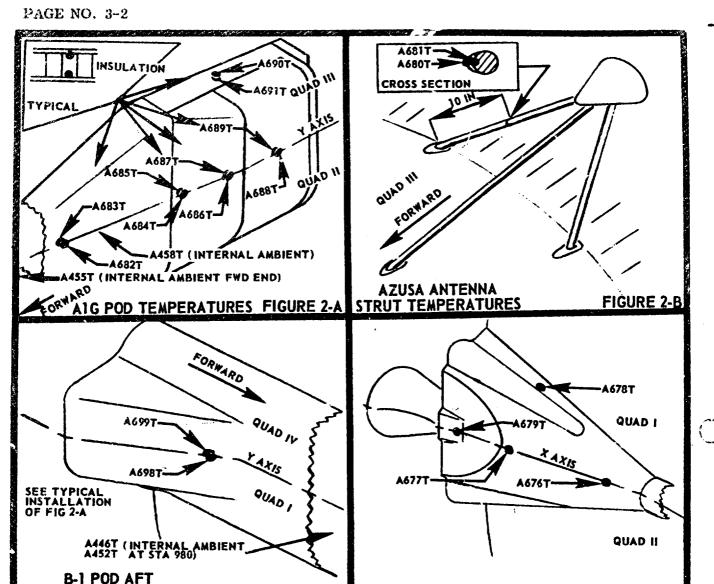


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Aerodynamic Heating

a. General

FAIRING TEMPERATURES

Heat resulting from friction and compression of the air molecules in the boundary layer adjacent to the surface of the missile, is transferred to the missile skin. The strength of the stainless steel, which is used as the basic structure of the propellant tanks, is a direct function of the temperature. Also, the helium requirements for tank pressurization are related to aerodynamic heating of the tanks.

V2 FAIRING TEMPERATURES

FIGURE 2-D

For analytical treatment of aerodynamic heating, heat transfer coefficients are formulated. This theoretical approach gives an indication of the rate at which heat is being transferred to the skin of the missile.

FIGURE 2-C

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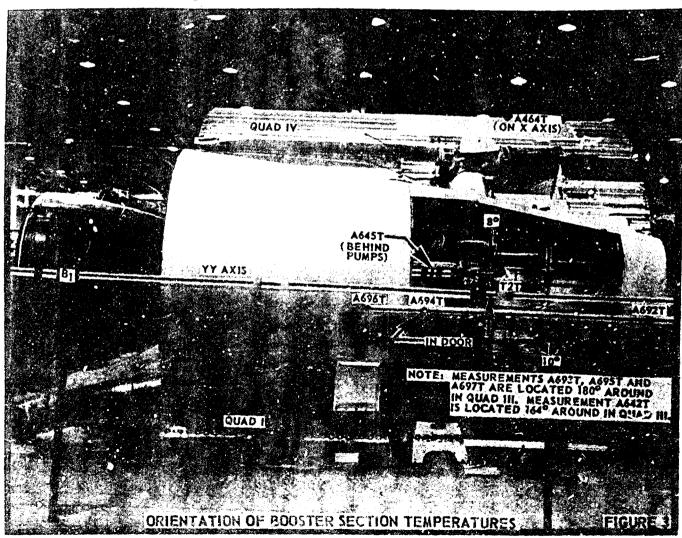
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To validate decretical temperature simulations, flight test temperature measurements on critical areas of the missile surface have been proposed. Areas of investigation have been selected to establish an over-all temperature profile. Information on the tank skin temperatures is needed to verify the interaction of complex shockwave phenomena about the new fairing configurations.

b. Measurements Planned

The following "E" series aerodynamic temperature measurements are included in the proposed ECP.

Three (3) measurements (A666T, A667T, A668T) are on the adapter. Seven (7) measurements are on or near the wiring and tubing tunnel fairing. Refer to "figure 1" for locations.



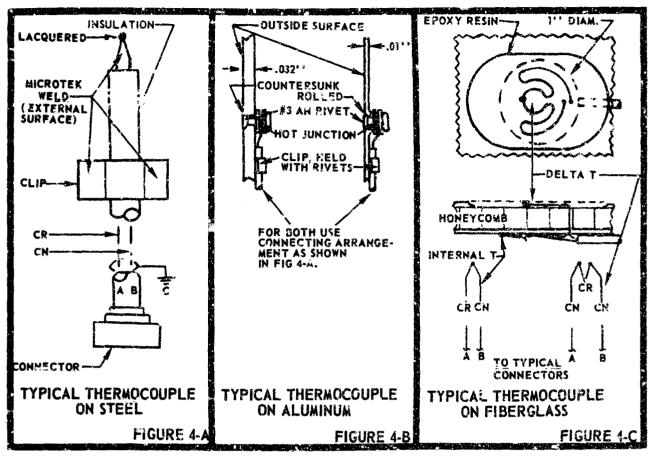
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Aerodynamic heating on the AIG pod will be indicated by measurements (A682T, A683T, A684T, A685T, A686T, A687T, A688T, A689T, A690T, A691T). These would provide temperatures on the inside and outside edge of the pod cover insulation at five (5) different points. See "figure 2-A" for locations.

The effectiveness of the laminated fiberglass fairing on the Azusa boom arteana to withstand aerodynamic heating, will be indicated by measurements (A680T, A681T). See "figure 2-P" for localisms.

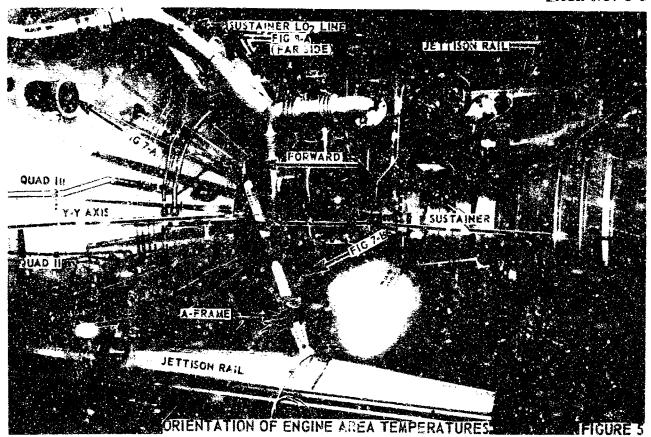
Temperatures on the B-1 pod aft fairing and the V-2 vernier fairing will be monitored by measurements (A698T. A699T) and (A676T; A677T, A678T, A679T) respectively. "Figures 2-C and 2-D" indicate transducer locations.

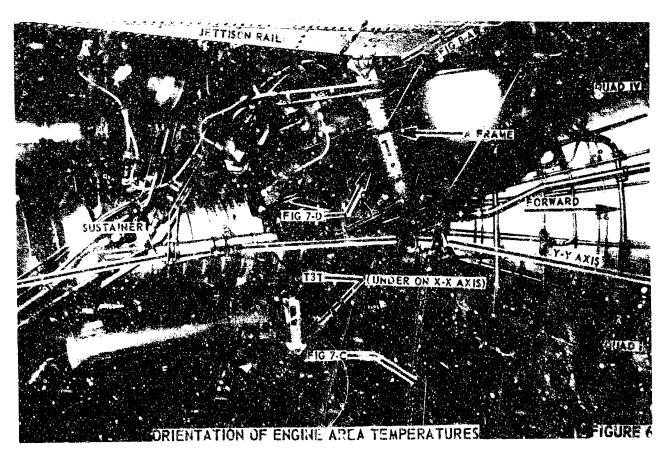
Booster nacelles and nacelle doors will have measurements (A692T, A693T, A694T, A695T, A696T, A697T) on the outside give line of the insultation honeycomb. Also one thrust structure skin temperature measurement (A464T) will be made. "Figure 3" indicates the locations of these transducers.

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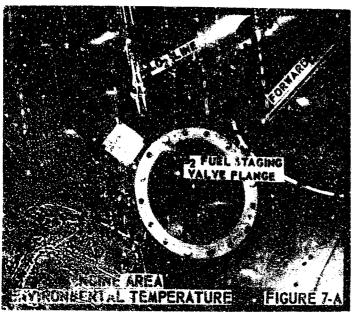


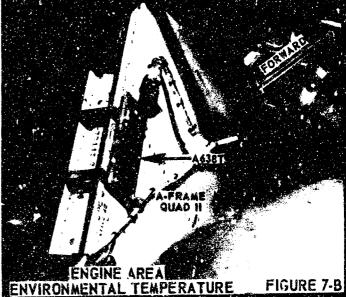
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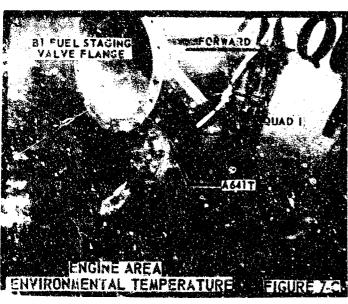


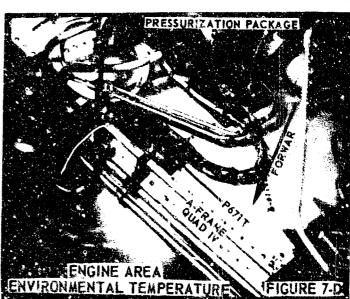
c. Instrumentation Techniques

In cases where the temperature to be monitored is on the tank skin (steel), chromelconstantan thermocouples are spot welded on. The advantage of this is the direct contact with the skin. Disadvantages are the protrusion into the airstream and a possible source of error from the reference junction.

When the chosen location is on aluminum (adapter, booster thrust section), the two junction wires are held between washers on a rivet.

The installation of therms suples on fiberglass (fairings, nacelles, etc), is accomplished by removing fiberglass, inserting the hot junction and refilling with epoxy resin.





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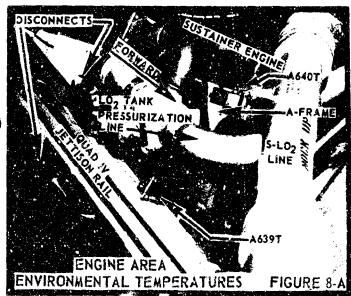
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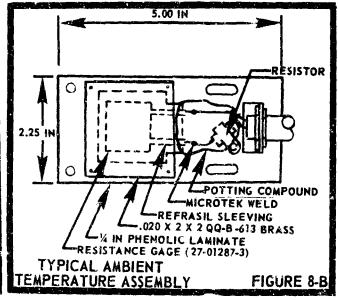
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Refer to "figures 4-A, B and C" for typical installation details.

Because of the large number of temperature measurements planned and proposed for the "E" series missiles, special telemetry capability will be required. It is planned to use inc vidual magnetic amplifiers for measurements on the first four flights. Beginning with flight five, it is planned to use one or two low level channels each employing one d-c pulse type amplifier. Each channel will have the capability for approximately 24 measurements. The number of channels will be determined by overall requirements for low level measurements.







One disadvantage to this method is that on any one flight, the maximum range spread of all the measurements are limited by the aim of the amplifier.

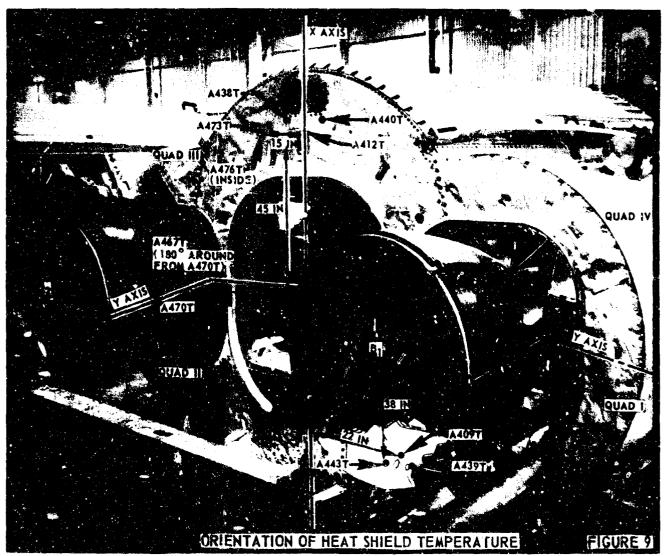
A reference junction is required to correct the final data from thermocouple measurements. The reference junction is designed and located so that it will remain near a constant temperature during flight. Two reference junctions will be used on "E" series missiles. Their temperature will be monitored on the first three flights to collect data for use with all thermocouple measurement data. See "figures 3 and 6" for locations of the sustainer area (T3T) and the B-1 area (T2T) reference junctions.

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Each aerodynamic measurement is planned only for three flights. The resulting three sets of data will normally provide repeatability and a high level of confidence in the results.

2. Equipment Area Environment

a. General

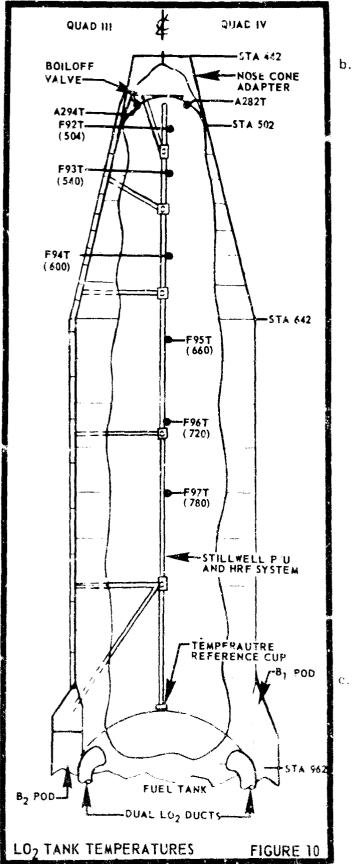
Proper operation of the electronic equipment mounted in the pods will be greatly affected by the temperature in which it exists. Engironmental heat is influenced by radiation of inner skin surfaces, radiation from self-heating missile components and by convection during periods of flight in atmosphere.

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b. Measurements Planned

Five measurements will be made on guidance components to confirm that they are in an acceptable operating environment. These measurements are on Gyro 1 (1531T), Gyro 2 (1532T), the Binnacle (I533T), the Analog Signal Converter (1534T) and the Computer (I535T). Five other equipment area temperatures are included in the proposed temperature survey Measurement (A479T) is proposed for the payload adapter section. This wul provide information on the ambient te nperature which payload mechanisms must operate. Measurement (A446T, A4521, A455T, A458T) are proposed in the cuble fairing area, B-1 pod, B-2 pod and AIG pod respectively. The measurement in the cable fairing area is intended to provide an indication of temperature at the telemetry wiring tray. The bod area ambients will furnish data on equipment environments and some insig t on the effectiveness of the insulation protecting the pods.

Refer to "figures 1, 2-A and 2 D" for approximate locations of the proposed measurements

Instrumentation Techniques

Guidance equipment temperatures a, cinstalled by ARMA and a conditioned signal is provided to CV-A.

CV-A environmental temperature measurements will be made with platinum resistance gages. These are attached by an adhesive to the object

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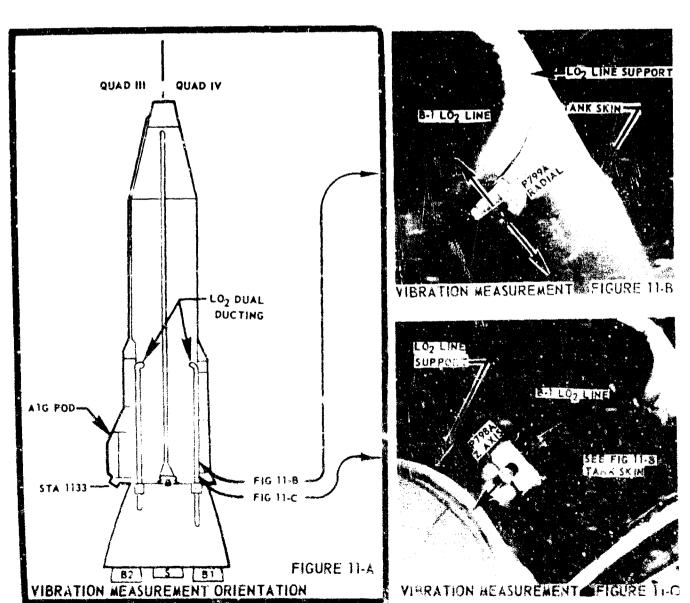
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being measured. In the case of ambient temperatures, they are mounted on a piece of brass which is in turn insulated from its attachment point. The brass is used to provide thermal inertia and reduce false indications from radiant sources.

 \mathbf{B}

The gage forms one leg of a bridge circuit, the output of which is made compatible with the amplification system used.

See "figure 8-b" for a typical ambient installation.



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3. Engine Area Environment

a. General

Environmental temperature can also greatly affect the proper operation of the hydraulic, pneumatic and propulsion equipment.

On "E" series missiles, the new MA-3 engines and associated changes in hardware location, could considerably alter temperature characteristics in the thrust section. The re-located turbopump exhaust and the changes in the heat shield are areas that should be studied to determine their effect on engine area environment.

In addition to providing environmental information, engine area ambients could provide correlation of random malfunctions such as propellant leaks or fires.

b. Measurements Planned

Eight thrust section ambient temperatures will be made on the first five flights (A488T, A638T, A639T, A640T, A641T, A642T, A645T, P671T). Measurements (A638T), on the aft side of the A-frame in quadrant II, and (P671T), on the aft side of the A-frame in quadrant IV, will be made on all flights. See "figures 7-b and 7-d" for locations. Since the booster gas generators and boost pumps are heat sources, ambients (A642T, A645T) will be located near them. Refer to "figure 3" for locations.

Details of location for the remaining ambients are shown in "figures 7-a, 7-c and 8-a." "Figures 3, 5, 6 and 9" indicate approximate locations for all planned and proposed engine area temperatures.

Eleven measurements in this area are included on the ECP to the Air Force. Each measurement is proposed for three flights. They are all intended to evaluate special area of interest.

Six calcrimeters, four gold and two black, are proposed (A409T, A412T, A438T, A439T, A440T, A443T), on the aft side of the heat shield. These measurements will provide information on base region heating. Because of the additional turbopump exhaust, new data is needed to determine the convective film coefficient, amount of radiation and partially evaluate the heat shield. To complete the evaluation of the heat shield, measurements (A473T, A476T) would be made on the aft and forward side respectively.

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(B)

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The engine exhaust jets are a source of heat input to the engine surface. Measurements (A467T, A470T) on the "hat section" of the engine surface will provide data on the amount of heating present.

See "figure 9" for locations of the above proposed measurements. To obtain information on the ability of the vernier heat shields to protect the internal components, measurement (A461T) is proposed on the aft side of vernier 1 heat shield.

c. Instrumentation Techniques

As previously discussed under equipment area environment, ambient temperatures will be made with platinum resistance gages on brass mounted with thermal isolation. See "figure 8-b" for a typical installation.

In cases where the expected temperature range exceeds 900 DGF thermocouples are used. These will be used in the manner discussed in "Instrumentation Techniques - Aerodynamic Heating", section I. A. 1.c of this report. Refer to "figures 4-a, 4-b and 4-c" for typical installation.

The calorimeters will be a metal block with a built-in thermocouple. In all of the above cases the resulting transducer output will be conditioned to make it compatible with the planned amplification system for telemetry.

4. LO₂ Tank Ullage Gas Temperature Study

a. General

During the course of a flight LO₂ tank pressure is maintained by helium and some unknown amount of gaseous oxygen.

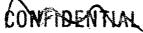
From a standpoint of burnout weight it is desirable to minimize helium requirements and the amount of gaseous oxygen.

In addition ullage gas temperatures effect boiloff rates, payload environment and seals in the pneumatic system.

b. Measurements Planned

Two measurements (A282T, A294T) will be made on the forward bulkhead. Six measurements (F92T, F93T, F94T, F95T, F96T, F97T) will be made

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at six different station levels near the center of the tank. These measurements are scheduled for four missiles. See "figure 10" for locations.

Helium flow rate data into the LO₂ tank will be obtained to support this study. Measurements (F65P, F147P, F146T) will be made for this purpose. Refer to "Supporting Systems Measurement", section IV of this report of additional details on helium flow rate instrumentation.

c. Instrumentation Techniques

The two bulkhead temperatures will be monitored by resistance gages. The six in-tank measurements will be made with thermopiles (two thermocouple junctions each) attached to the stillwell.

The resulting signals will be conditioned for telemetry in a manner similar to those discussed in previous sections of this report.

One significant difference will be the use of LO_2 as the reference temperature. This will be accomplished by installing a "cup" on the bottom of the stillwell to retain LO_2 near the end of flight.

B. Vibration

1. Low Frequency Vibration (0 to 50 CPS)

No low frequency accelerometers are planned for "E" series flight missiles.

2. High Frequency Vibration (20 to 2000 CPS)

a. General

The performance of electronic and light mechanical components is influenced by the environment created by high frequency vibrations. The combustion processes of the engine and aerodynamic turbulence act as sources for vibrations which are transmitted through the airframe.

Since the "E" series missiles are different from previous missiles, extensive vibration studies will be made. Primarily these studies will be made on captive test articles. However current planning calls for airborne instrumentation in two special areas of interest. These areas are: the guidance equipment and the LO₂ ducting near the staging valve.

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Possible expansion of this to include other areas is presently under consideration.

b. Measurements Planned

Concern has been expressed on forces imposed on the ${\rm LO}_2$ ducting when the staging valve closes. Pressure surges resulting from the valve closure may be excessive. Two measurements, (P798A, P799A), will be made on the B-1 ${\rm LO}_2$ line. These measure axial and lateral acceleration respectively. The data obtained will be used to verify design calculations and to initiate design changes if required. See "figures 11-A, B and C" for installation details.

Six measurements are planned on the first four missiles on the guidance equipment. These will be made on the computer (I5640, I5650, I5660) and on the binnacle (I5600, I5610), I5620). Data from these measurements will aid in the evaluation of guidance equipment operation and, since these same measurements will be made on D-AIG missiles, will provide information for comparison of D and E series vibration characteristics.

c. Instrumentation Techniques

The LO₂ duct measurements will be made with a Gulton KA-1006 system, composed of an A-395TMUC accelerometer and a FT-521U, amplifier, has been selected. The accelerometer is a piezoelectric type with a nominal sensitivity of 41.6 MV/G. The amplifier gain is variable from 5 to 50. The complete system sensitivity is flat to \pm 3% over the temperature range of -30 to +185 DGF, and has a cross-axis sensitivity of less than 5%. The range will be \pm 60 g's with response to 100 cps.

The guidance equipment measurements were scheduled to be made with Glennite Model A40TM triaxial accelerometers. However due to problems encountered with this unit on D-AIG missiles a change is expected. The A40TM is a case isolated, bender type, crystal accelerometer with a 7 mv/g nominal output over the desired accelerometer range. It is linear to \pm 3% over the frequency range of 3 to 3 KC, under a termperature environment of -65° F to 180° F. These accelerometers, and the required signal conditioning, will be provided and installed by ARMA.

This data will be transmitted on a 1/8 rps commutator with the segments connected so that each measurement will be monitored for one second

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every eight seconds. The recorded information will be analyzed by both CV-A and ARMA.

C. Staging Instrumentation

Booster staging is initiated from the guidance system as a discrete command which is telemetered (I570X). The force for releasing the staging latches is obtained from the pneumatic controls bottle. Bottle pressure (F145P) and the command to the conax valve (M32X) are monitored. To establish that similtaneous release of all latches occurs, a micro switch is mounted on each latch (illustrated in Figure 12). As the latch unhooks, each micro switch initiates an electrical signal, (measurements M84X, M85X, M86X and M87X).

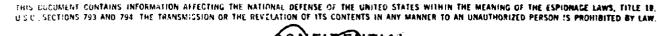
To verify that separation occurs properly the relative motion between the missile and the booster section is monitored. A "fishing reel" type potentiometer (M. i3D) is mounted on the sustainer stage with one end of the reel wound wire attached to the jettisoned stage. As the reel unwinds during separation, the resistance of the potentiometer varies as a function of separation. The potentiometer makes one complete revolution for each eight inches of separation. The output signal is there for a sawtooth wave each cycle of which represents eight inches of separation.

Supporting information for booster separation will be obtained from guidance acceleration data.

D. Fire Detection

The knowledge that an open flame existed is not particularly valuable information unless the cause or source can be pin-pointed. Often, the pressure drops associated with leaks or small line ruptures are too insignificant to be detected on associated instrumentation. Consequently, a fire detection device which can indicate location and perhaps give a clue to magnitude is an asset for failure analysis. To know whether a line rupture or wiring failure gave rise to a fire or were the result of a fire is invaluable for failure analysis.

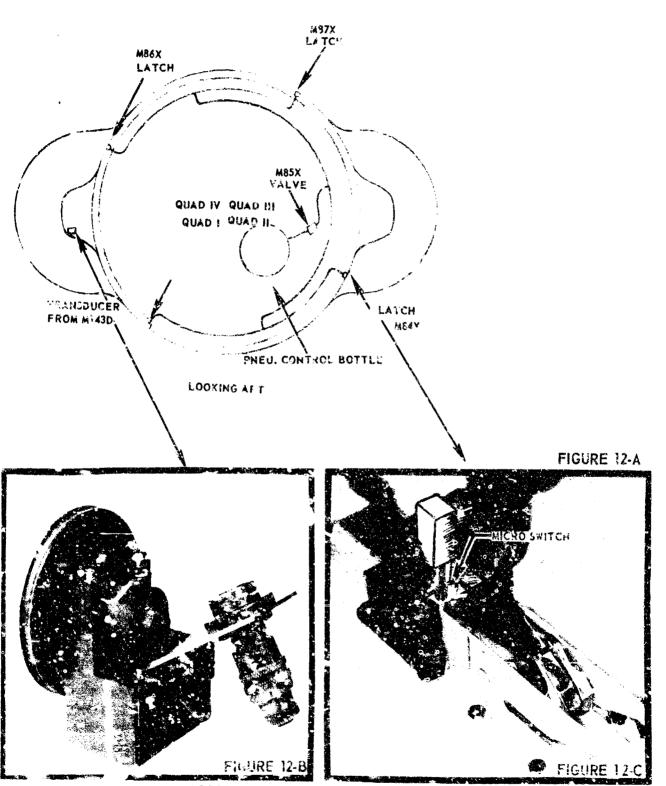
Missile-borne temperature measurements, in addition to providing system evaluation and performance data, can in cases indicate adverse temperature conditions which are the result of a fire. However, a system designed specifically for fire detection is the most practical approach.





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BOOSTER STAGING INSTRUMENTATION

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In considering a system for fire detection, an array of thermocouples strategically placed provide a relatively good picture of ambient conditions. The limitation for flight articles is the number of telemetry channels required.

E flight missiles will have four landline measurements for engine compartment temperatures at firing P1710T, SE ENVIRONMENT (Quad 2 near sustainer hydraulic pump); P1711T, B1 NACELLE AMBIENT (Sta 1200 Quad 4 near the accessory pad drive); P1712T, B2 NACELLE AMBIENT (Sta 1200 Quad 2 near the accessory pad drive); P1325T, ENG COMP AMBIENT (Quad 4 on A-frame near the pressurization package). Eight telemetered temperatures will give an indication of engine compartment ambient during flight. For locations, refer to illustration 7-3.

An additional system for flame detection is installed on E flight missiles. Six silicon cells are installed in the thrust section in two clusters of three. Each cluster is mounted on a booster engine ${\rm LO}_2$ dome. The cell outputs in each cluster are summed and telemetered. The cells are positioned such that they "look" toward the following areas:

B1 cluster - A2851

できるとは、一般の意味を表現のなど、大きなない。

B2 cluster - A744I

Cell 1 - B1 gas generator

Cell 1 - B2 gas generator

2 - B1 gimbal

2 - B2 gimbal

3 - Sustainer gas generator

3 - Helium bottles (quads 3 & 4)

The cells are calibrated such that 600 foot-candles on any cell represents 100% information band-width. In analyzing data from the cells, the following characteristics should be considered.

- 1. Output is low; this increase susceptibility to noise.
- 2. Sensitivity is not linear for radiant flux in the visible light bandwidth.
- 3. Transducer is temperature sensitive.
- 4. For a given radiant flux intensity, output varies with angle of incidence.

These measurements are also located in illustration 7 3.

At present, there are several new systems! ing evaluated for fire detection. They are ultra-violet sensitive and give positive indication of open flame. The

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disadvantages of the solar cells have been overcome and it appears that one of these systems may alleviate the shortcomings of all presently used systems.

−(B)

II. PROPULSION SYSTEM MEASUREMENTS

The propulsion system can be conveniently subdivided into the areas of propellant pumping drive system, propellant flow, engine controls, engine performance, and propellant utilization.



A. Propellant Pumping Drive System

At engine start the ignition of the solid propellant gas generator cartridges spin the turbopumps which bring the engines to full operating levels. These cartridges also ignite the propellants arriving at the three separate gas generators before burning out.

An orifice in each gas generator LO_2 line controls the LO_2 pressure and flow to the gas generators and, hence the engine power levels. Each gas generator LO_2 injection manifold pressure (P337P, P419P, P420P) is measured to ascertain proper performance.



The gas generator hot gas temperatures (P709T, P713T, P714T) are monitored as these functions indicate gas generator performance and, therefore, the values of the turbine driving parameters. Turobpump speeds (P85B, P84B, P349B) and fuel pump discharge pressures (P38P, P39P, P300P) are measured as they are the end parameters in this area and are representative of the overall propellant pumping system operation.

B. Propellant Flow

During the booster and sustainer stages, liquid oxygen and fuel from the main tanks flow through individual turbopumps to each thrust chanber. The turbopumps increase propellant pressures to that required for adequate propellant injection.

B

In order to assure that engine interface requirements are satisfied and to isolate failure analysis possibilities, the turbopump fuel discharge pressures (P38P, P39P, P330P), the LO_2 injection manifold pressures (P91P, P92P, P351P), and the sustainer turbopump LO_2 inlet temperature (P530T) and pressure (P56P) will be measured.

(B)

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The engine compartment ambient temperature instrumentation will help reveal if there is a leak in the LO₂ ducting during flight.

The sensitive and accurate turbopump speed measurements (P83B, P84B, P349B) will respond rapidly to varying pump inlet and outlet conditions. Thus these measurements will reflect turbopump cavitation very quickly.

-(B)

C. Engine Controls

In the MA-3 engine, only the vernier engine controls are pneumatically operated. Helium is supplied by the non-jettisoning helium controls bottle which connects to the vernier pressurization manifold and inter-stage separation fittings. The manifold supplies pressure regulated helium to actuate the vernier propellant valves and to pressurize the fuel and LO₂ vernier feed tanks. The vernier pressurization manifold regulator discharge pressure (P474P) will be monitored on the first three flights to determine regulator performance in a flight environment. The controls helium usage will be computed for the first three flight articles from data gained by temperature (F290T) and discharge pressure (F145P) instrumentation in the controls helium bottle. The latter measurement (F145P) will be retained on all flight articles for failure analysis purposes. The vernier propellant tank pressures (P27P, P30P) will be monitored for pressurization timing and levels, and correlation with vernier engine performance.

The booster main propellant valves are controlled by fuel pump discharge pressure. The response and effectiveness of these valves will be indicated by the booster thrust chamber LO₂ injection pressure instrumentation (P91P, P92P).

Practically all the sustainer engine control valves are hydraulically operated. The actuating pressure (H140P) derived from the sustainer hydraulic system, will be monitored on all vehicles. The sustainer main valve position (P528D, P529D), and gas generator (P337P) and thrust chamber (P351P) LO₂ injection pressure instrumentation will help reveal if the various sustainer control valves are operating properly.

-(B)

In order to determine the timing of engine scutdowns, the various engine cutoff sequence functions will be monitored (P1155X, P1164X, P347X, P1546X, P547X, P548X). The engine start signals (P1161X, P1544X, P1545X, P1549X) are recorded to obtain a record of starting times and run durations.

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D. Engine Performance

The most significant engine performance parameters are propellant mixture ratio, and engine thrust and specific impulse. Engine thrust calculations will be based on chamber pressure information (P6P, P28P, P29P, P59P, P60P) and engine coefficients obtained during acceptance tests. Missile acceleration data gained from the guidance system (I1515A, I516A, I517A, I1518A, I519A, I520A) will permit an analysis of engine thrust decay and specific impulse. An estimate of propellant mixture ratio can be gathered from PU system information (U80P, U81P, U91V).

E. Propellant Utilization System

Optimum range and trajectory dictate a minimum amount of unused propellants at the end of powered flight. The propellant mixture ratio also must be maintained within specified limits from the nominal value to insure smooth combustion and maximum thrust. Extensive P.U. analyses based on the above criteria have been made from previous flight test data and computer studies. Instrumentation on E series is limited to further verifying these studies, and to indicate any possible malfunction should such occur.

The error sensed by the P.U. bridge after passing through the isolation amplifier and demodulator is recorded via telemetry. This voltage measurement (U91V) is proportional to the residual mixture ratio. When compared to the independent measures of propellant head (U80P and U81P), proper performance of the P. ... manometer sensors and associated bridge can be checked during the latter portion of sustainer flight.

The transfer functions in the P.U. computer will be verified by core ingrether feedback voltage (P528D) to the error signal. Since P528D is a final live angle, it is also indicative of fuel flow rate.

The independent measurements of differential (propellant) head are one of during the latter portion of the sustainer phase of hight only. Present planning is for these measurements (U80P and U81P), to be taken by 0 to 5 PSID reluctance type transducers teed in parallel to the manometer sensing lines. "Mechanical hysteresis" is minimized in transducers of this type with a corresponding improvement in data accuracy. It is estimated the change of slope of the data when 0 PSID is reached (port uncovering) will define the residual of either propellant within an uncertainty of 50 pounds.

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Proper functioning of the Head Suppression Servo Controller can be verified from the relation of P. U. valve position and the sustainer main LO_2 valve (P529D).

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III. FLIGHT CONTROL SYSTEM MEASUREMENTS

Throughout powered flight, the control system provides attitude control while directing the missile along its predetermined flight path. Also, the control system performs the necessary sequencing at launch, staging, burnout and nose cone separation. At the same time, due to the natural aerodynamic instability of the missile, sufficient control must be provided to overcome the disturbing effects of extraneous forces encountered by the missile during flight.

The control system is conveniently separable into two major subsystems, the airborne autopilot system and the inertial guidance system.

A. Autopilot

- 1. General The autopilot system has four basic functions:
 - a. To roll the missile to the proper azimuth during the initial vertical climb and to pitch the missile over into the proper trajectory prior to development of the inertial ballistic trajectory;
 - b. To stabilize the missile during powered flight;
 - c. Through acceptance of the pitch yaw and roll guidance commands, to correct for deviations from the proper trajectory; and
 - d. To provide pre-set switching functions including,
 - (1) command discrete acceptance, enable, and pre-set back-ups,

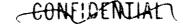


- (2) gain changes, and
- (3) various subroutines.

The autopilot system for "E" series will function essentially in the same manner as it has for "D" series. However, the system has been repackaged and several components have been redesigned. A significant hange in autopilot operation was necessitated by the incorporation of the MA-3 propulsion system. It is no



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longer necessary to null the sustainer engine at staging since on the MA-3 engines there is adequate clearance, therefore the sustainer will gimbal throughout staging. The autopilot programmer has been redesigned and is now all electronic, however, it still provides the same functions and performs the same operations as before. The only change in the gyro package is the addition of a roll torquing amplifier. In the servo can, pitch, yaw and roll filters have been added. There are also new all electronic filters incorporated to replace the old electro-mechanical integrators. The filters use the operational amplifier technique of a d-c amplifier having an input and a feedback network that provides the same frequency response that electro-mechanical integrator and stabilization filter provided. The servo amplifier has remained unchanged. The entire autopilot system has been repackaged into rectangular shaped units utilizing printed circuitry to accomplish weight saving and more efficient space utilization. The rectangular shaped packages have magnesium castings with aluminum covers. The flight programmer has no moving parts and the reliability has been increased with the incorporation of printed circuitry. The weight of the flight programmer, however, has increased slightly.

2. Measurements Planned

To prove the capability of the autopilot system to perform the required functions, autopilot testing will be emphasized in the flight testing of the missile. The instrumentation provided for this purpose is described below, with the measurements discussed by their natural groupings.

a. Rate Gyro Signals (S52R, S53R, S54R)

These are measurements of the voltage output of the roll (\$52R), pitch (\$53R) and yaw (\$54R) autopilot rate gyros. This output is proportional to the angular relocity of the missile, and is the means through which dynamic stability of the missile is achieved in flight. These measurements actually provide a time history of missile stability during flight. Transients, limit cycle sloshing build-up, and other instabilities are all reflected in the information.

To provide isolation of the control system from the telemetry system, each rate gyro biases an emitter follower to produce a signal for telemetering. Since the output of the rate gyros is an amplitude modulated, 400 cycle phase reversing Ac signal, the output of the emitter follower also has these characteristics. Conversion of the signal is accomplished by routing the signal through a demodulating signal conditioning network.

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The conditioned signal is then telemetered on the FM/FM Channels 1.8, 1.9 and 1.10 on all E flights.

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b. Displacement Gyro Signals (S61D, S62D, S63D)

These measurements reflect missile angular displacement about a preset reference in the roll (S61D), pitch (S62D) and yaw (S63D) channels. Position control of the missile is controlled through these gyros, which may be torqued by either the guidance system, or by the flight programmer.

—(B)

Although the output of these gyros is a position command signal, the units actually sense a rate of displacement about the reference. This is integrated within the package to obtain a position signal output. As in the case of the rate gyros, the telemetry signal is obtained from an emitter follower whose output is proportional to the displacement gyro output. Since this is a phase reversing, 400 cycle amplitude modulated signal, it is demodulated and signal conditioned to make it compatible with the telemeter. The information is cross-connected on a commutator to give 20 samples per second.

c. Thrust Chamber Positions (S203D, S204D, S205D, S206D, S222D, S223D, S233D, S234D, S256D, & S257D)

-(B

These are measurements of the output of the flight control system, and as such, are important for gross malfunction and failure analysis. The booster and sustainer thrust chamber deflections are sensed by linear potentiometers, one in each plane of gimbaling freedom which are shaft coupled to the gimbal block. Since 5 VDC is applied across each potentiometer, the output of the transducers vary between 0 and 5 VDC as the thrust chambers gimbal between their stops. The outputs are then routed through conditioning circuitry. On all E missile flights, the B1 (\$203D, \$205D) and sustainer (\$256D, \$257D) engine position measurements are telemetered on continuous channels, while the B2 (\$204D, \$206D) engine position information is commutated at 60 samples per second.

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The vernier (S222D, S223D, S233D, S234D) engine position movements are sensed by linear potentiometers which are mechanically linked to the vernier actuators. The pitch transducers have a full scale travel of 1.091 inches, and the yaw transducers have a full scale travel of 3.054 inches. 5 VDC is applied across each conditioning network to obtain a signal suitable for telemetering and then routed to RF2, Channel E, for time division multiplexing at 60 samples per second, prior to transmission.

d. Programmer Functions

The autopilot programmer receives discrete commands from guidance, acts upon them, and as a final result - performs switching to pass these or resulting command signals to the acting system.

On the "E" series missiles, three discrete commands are received from guidance. They are monitored as staging signal (1570X), sustainer cutoff (1522X) and vernier cutoff (1521X).

The staging signal initiates subroutine 1 in the programmer. Booster cutoff occurs 0.1 seconds later. This is monitored in a B1 cutoff relay closure in the NAA engine relay box (P547X). At 1.6 seconds after the staging discrete, a command opens the Conax valve allowing pneumatic pressure to operate the staging mechanisms. The command to the valve is measured as (M32X).

(B)

Sustainer cutoff discrete initiates subroutine 2 at the programmer and operates a relay in the NAA engine relay box. The operation of this relay is monitored as (P347X).

Vernier cutoff discrete initiates subroutine 3 at the programmer and operates a relay in the NAA engine relay box. This relay is instrumented as (P548X). Four seconds after VCO; a release payload signal (S248X) is sent.

B. Guidance

1. Functional Description

All E Series flight missiles will be guided by the ARMA All Inertial Cuidance System. The Missile Guidance Set (MGS) is the Airborne

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portion of the guidance system. The MGS consists of an inertial platform, control unit and digital computer. In addition, for R&D instrumentation purposes, analog and digital signal converters and an analog signal converter input filter unit are also utilized.

The inertial platform is precisely oriented by ground-based alignment equipment prior to launch. After the missile is launched, gyros in conjunction with a servo system are utilized to maintain this orientation of the platform with respect to inertial space. Accelerometers, located on the platform sense the acceleration of the missile in three orthgonal directions. These values of acceleration are corrected to include gravitational acceleration and then integrated in the airborne digital computer for computation of yaw steering commands, the Range Error Function (REF), and the Crossrange Error Function (CEF)

The MGS generates sceering commands from launch throughout powered flight but these signals are not enabled by the Autopilot programmer until appropriate times in flight. A fine-roll control signal is provided by the MGS platform azimuth resolver. This signal is used to correct the autopilot roll program from T + 16 to T + 19 seconds. The MGS pitch gimbal resolver output is fed directly to the autopilot to control the missile pitch attitude after booster staging. The Crossrange Error Function (CEF) is computed from accelerometer outputs and is stored in the computer until after booster staging. After staging the accumulated CEF in combination with subsequent calculations of CEF is fed into the autopilot as a yaw steering command.

Four discrete commands, staging, sustainer engine cutoff, vernier engine cutoff and warhead pre-arm, are generated by the MGS. When the down-range velocity exceeds a predetermined value the staging discrete is commanded. The REF computed from the accelerometer data is the basis for the generation of the staging, sustainer engine cutoff and vernier engine cutoff. Providing that the operational flight safety function of the computer predicts a generally correct impact the computer commands warhead pre-arm.

2. Accelerometer Output Measurements (1513A, 1514A, 1516A, 1517A, 1519A, 1520A)

Three vibrating string accelerometers are installed on the stable platform. Each accelerometer contains a sensitive mass which is held in position by

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two vibrating strings and centering tapes. The frequency of each of the accelerometer strings is approximately 4480 cps in a "O" G field. As acceleration increases, the frequencies of the two strings vary inversely with respect to each other at rate of 64cps/G (32cps/G/String). To avoid transmitting the 4480 cps signals directly, the Y (11516A, 1519A) and Z (1517A, 1520A) axis accelerometer outputs are heterodyned with a 4100 cps signal in the analog signal converter (ASC) before being telemetered.

If the string frequencies go below 4150 cps and are heterodyned they are attenuated greatly and are of no value. This then allows for string frequencies equivalent to approximately 11 G acceleration to be heterodyned. It has been calculated that acceleration in the X direction may momentarily exceed 11 G's due to high acceleration in the X direction (downrange), noise, vibration, missile acceleration characteristics, and characteristics of the platform shock mounts. In addition in order to reduce the string frequency data accurately, both string frequencies of each accelerometer must be telemetered directly or both must be heterodyned with the same frequency before being telemetered. Therefore, the two string frequency measurements from the X accelerometer (I513A and I514A) are not heterodyned but are telemetered directly.

The string frequencies of each accelerometer are fed directly into the airborne computer. In the computer the sum and difference in CPS between the two string frequencies of each accelerometer is used to calculate missile vector velocity, position and steering functions.

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The basic equation used is:

$$V_{x,y,z} = K_{x,y,z} F_{s_{x,y,z}} C_{d_{x,y,z}}$$

Where $V_{x,y,z}$ is the instantaneous velocity x,y, or z in ft/sec

 $\mathbf{F_{S_{X,\,y,\,z}}}$ is the sum frequency in CPS of the X,Y, or Z accelerometer

 $C_{d_{X,y,z}}$ is the total counts of difference frequency (CPS X time) of X, Y, or Z accelerometer from t=0.

The constant $K_{x,y,z}$ is in ft/ $[\sec^2 (CPS)^2] = ft/cycle^2$ of the accelerometer in question.

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3. Digital Measurements

The following computer functions are sampled and transmitted in digital form via the telemeter.

Computed missile X position and X vector velocity (I505H, I502L)

Computed missile Y position and Y vector velocity (1506H, I503L)

Computed missile Z position and Z vector velocity (I507H, I504L)

Range Error Function (I508H)

Crossrange Error Function (I509H)

Elapsed Time (I510W)

These 9 measurements are serial, binary non-return-to-zero words. The complete sequence is shown in the Inertial Guidance Digital Word Structure Schematic. The smallest repeatable pattern is a cycle recurring every 0.5 second and each cycle is divided into 8 similar sequences of about 1/16 second duration. A start pulse precedes each cycle and a sequence start pulse of 5580.4 u seconds precedes each sequence. All words are contained in each sequence except CEF which is inserted during sequence 6. However, each sequence is the same length. Each word is 20 bit (non-return-to-zero) and each bit is about 140 u seconds long. The data word is 17 bits and the other 3 bits are used for marking the start of the word, indicating the sign and indicating the word parity (total data word sum is odd or even). Words X, Y and Z are repeated each sequence but change only once per cycle. T and REF may change each sequence.

The measurements themselves are sampled from the computer and the pulses stretched and conditioned in the Digital Signal Converter. Their output impedance is 14K and the signal level will vary between 0.5V and 5V. The velocity and position measurements will be compared with external tracking data (i. e., Azusa, Mod III Trajectory Instrumentation and Strobe Light) to verify the accuracy of the guidance computer outputs. In |-B addition, as stated in the discussion of the accelerometer measurements, the airborne computer output measurements will be compared with values computed independently in a ground computer.

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The following table presents the value represented by each bit of each of the nine digital words.

HB

Bit	ft/sec	Sec	feet	Radians	Radia RE	
Position	x y z	Т	хуг	CEF	T ≤ SCO	T ≥ SCO
1. WORD MARKER PULSE						
2.	2 ⁻² . 25	0	2 ⁶ 64	2 ⁻¹⁶ . 000015259	2 ⁻¹² . 000244141	2-17 . 000007629
3.	2 ⁻¹	0	2 ⁷ 128	2 ⁻¹⁵ . 000030518	2 ⁻¹¹ . 000488281	2 ⁻¹⁶ . 000015259
4.	2 ⁰	0	28 256	2 ⁻¹⁴ . 000061035	2 ⁻¹⁰ . 000976562	2-15 . 000030518
5.	2 ¹ 2	2 ⁻⁴ . 0625	2 ⁹ 512	2 ⁻¹⁵ . 000122070	2 ⁻⁹ . 001953125	2 ⁻¹⁴ . 000061035
6.	2 ² 4	2 ⁻³ . 125	2 ¹⁰ 1024	2 ⁻¹² . 000244141	2 ⁻⁸ . 00390625	2 ⁻¹³ . 000122070
7.	2 ³ 8	2 ⁻² , 25	2 ¹¹ 2048	2-11 . 000488281	2 ⁻⁷ . 0078125	2 ⁻¹² . 000244141
8.	2 ⁴ 16	2 ⁻¹	2 ¹² 4096	2 ⁻¹⁰	2-6 . 015625	2-11 . 000488281
9.	2 ⁵ 32	2 ⁰ 1	2 ¹³ 8192	2 ⁻⁹ . 001953125	2 ⁻⁵ . 031250	2 ⁻¹⁰ . 000976562
10.	2 ⁶ 64	2 ¹	2 ¹⁴ 16384	2 ⁻⁸ . 00390625	2 ⁻⁴ . 0625	2 ⁻⁵ . 001953125
11.	2 ⁷ 128	2 ² 4	2 ¹⁵ 32768	2 ⁻⁷ .0078125	2 ⁻³ . 125	2 ⁻⁸ . 00390625
12.	2 ⁸ 256	2 ³ 8	2 ¹⁶ 65536	2-6 . 015625	2 ⁻² . 25	2 ⁻⁷ . 0078125

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В

Bit Position	ft/sec • • • • x y z	Sec T	feet x y z	Radians CEF	Radia RE T SCO	
13.	2 ⁹ 512	2 ⁴ 16	2 ¹⁷	2 ⁻⁵ . 03125	2 ⁻¹	2 ⁻⁶ . 015625
14.	2 ¹⁰ 1024	2 ⁵ 32	2 ¹⁸ 262144	2 ⁻⁴ . 0625	2 ⁰	2 ⁻⁵ . 03125
15.	2 ¹¹ 2048	2 ⁶ 64	2 ¹⁹ 524288	2 ⁻³ . 125	2 ¹	2 ⁻⁴ . 0625
16.	2 ¹² 4096	2 ⁷ 128	2 ²⁰ 1048576	2 ⁻² . 25	2 ²	2 ⁻³ . 125
17.	2 ¹³ 8192	2 ⁸ 256	2^{21} 2097152	2 ⁻¹	2 ³	2 ⁻²
18.	2 ¹⁴ 1°384	2 ⁹ 512	2 ²² 4194304	2 ⁰	2 ⁴	2 ⁻¹
19.	SIGN-					
20.	PARITY-					

NOTES:

Numbers less than 2⁻⁹ have been rounded off to 9 significant figures.
 CEF and REF computations will still be good to at least seven significant figure.

2. The sum of all numbers less than 2⁻¹¹ contribute only .2 milliradian to the REF and CEF computation. Therefore, except for CEF and REF values near zero, these numbers can safely be neglected for most purposes.

3. Time begins on the left. i.e., the word for a appears first in the DSC output after the sequence marker, followed by y, etc., with REF being

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the last word before the next sequence marker. Bit position is also read from left to right. That is, the least significant bits appear first.

4. Resolver Output Measurements (I529V, I530V, I580V)

Resolvers are located at each platform gimbal. When the missile changes attitude, the gimbal angle changes correspondingly. The resolver signals are proportional to the gimbal angle and thus to missile attitude. All the resolver outputs are 400 cycle, amplitude and phase modulated signals which are compatible with the autopilot and are therefore suitable for steering.

The roll resolver does not serve any purpose with the present configuration during flight. Pitch resolver output is fed directly to the autopilot to control the missile pitch attitude. The Azimuth resolver will be used to correct the missile roll program. This resolver is used since AIG Azimuth corresponds to missile roll at launch. The CV-A autopilot will roll the missile from to to fifteen seconds. Then the azimuth resolver will make corrections to this roll program from 16 to 19 seconds. The roll adjustment is capable of correcting 10 degrees of error. The resolver signals can be used to obtain missile attitude information as well as detecting guidance system inalfunctions.

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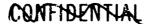
5. Yaw Steering Measurement (I528V)

The Crossrange Error Function (CEF) is computed from accelerometer outputs and stored in the computer until after missile staging. After suging the accumulated CEF in combination with subsequent calculations of CEF is fed into the autopilot as a yaw steering command. The yaw steering signal is a '00 cycle phase reversing signal that is used to torque the autopilot gyros. The magnitude of the yaw steering command is controlled by the amount of CEF calculated by the computer. This signal is conditioned in the Analog Signal Converter before being telemetered.

6. Servo Error Measurements (I549D, I550D, I551D)

These are measurements of the corror signals in the platform servos which maintain the platform (and thereby the accelerometers') initial orientation. The servo errors, which are derived from the gyro outputs, are basically AC signals (40V max) but for telemetry purposes are demodulated in the ASC and their output is biased at 2.5 VDC to provide for positive and negative signals.

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Two servo motors are used to take out backlash from the servo system. This is accomplished by constantly applying approximately 20 volts to the field of each motor in a direction which causes the motors to appose each other. A differential signal of 1 to 2 volts is necessary to break sticktion in the motors and cause the platform to move. This prevents noise from moving the platform. In the ASC the two control voltages are combined for telemetering into one signal equal to their difference. These are gross malfunction measurements only. They indicate whether or not the platform is following the gyro outputs.

7 Redundant Gyro Measurement (I552D)

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Two gyros are utilized to sense platform attitude—Gyro B senses changes in roll and azimuth. Gyro A senses changes in pitch and roll/azimuth (redundant). The gyro B roll and azimuth output signals and the gyro A pitch output signal are fed through a servo loop to torque the platform and thereby null the gyro outputs in these three axes. If there is any displacement in the redundant gyro axis, a signal is fed from a closed-loop amplifier to torque the gyro and thereby keep it centered between the mechanical stops. These stops are provided for all gyros and prevent an alignment error greater than two degrees between the gyro axis and the stable platform. If the redundant gyro axis is not kept at null, precession of gyro A about the Y axis may result. This measurement is used for gross malfunction data, determining the error in the nulling circuit, and as a rough measure of gyro drift.

8. Time T Measurement (I581W)

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Time T is the time at which the "O" offset of X accelerometer is removed and also the time of initiation of operational flight safety. The operational flight safety program is effective from time T to sustainer engine cutoff. If the Azimuth resolver goes beyond a certain value after time T, no prearm signal will be initiated. This measurement may be used to explain why no pre-arm signal was sent to the nose cone.

A zero offset control unit is used to adjust the accelerometer output frequency to correct for accelerometer scale factor deviations from the value which the computer has been designed to operate upon. This signal biases the accelerometer output until a signal is sent from the computer (at time T) which removes the offset bias. This correction is made only to the X accelerometer since it is the most critical.

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9. Computer Redundancy Measurement (I537X)

Each arithmetic computation is made in parallel in the computer. If the results of the two do not compare within limits, a pulse is telemetered.

10. Staging, SECO, and VECO Discretes (I521X, I522X, I523X, and I570X)

When the downrange velocity exceeds a predetermined value the staging discrete is initiated and transmitted as a 28 VDC signal to the CV-A autopilot. This 28 VDC signal is monitored (I521X) at the cutput of the computer.

The REF computed from accelerometer data is the basis for the generation of the sustainer engine cutoff and vernier engine cutoff. Both these discretes are monitored (I522X and I523X) directly as 28 VDC signals which are transmitted to CV-A autopilot programmer. These two discretes are also tied together for instrumentation purposes (I570X). All three of these measurements are "blipped" as well as transmitted over a commutated channel.

11. Pre-arm Signals (I525X, I526X, and I527X)

The computer unit contains two counters, with two stages each. Part of the program consists of an examination of REF, CEF, and incremental velocity to assure that they are smaller than some predetermined value. When any one of these conditions is met the counter is advanced by "one". When all these conditions have been met the counter will sit in the "three state". When the test is performed again, the second counter is advanced. When both counters are in the "3" state a pre-arming signal is given by the closure of two series-connected relays as a 28 volt DC signal. The output of each counter is monitored (1525X, 1526X) and the closing of these relays is monitored (1527X) by telemetering the output signal. These measurements are all direct measurements of the 28 VDC control sign

An operational flight safety system is provided which makes a crude independent check of the system's performance. Briefly, the flight safety monitor checks the platform for excessive drift and checks the system for excessive yaw steering. The overall functioning of this unit is checked by monitoring the pre-arm signal (1-7X) at the output of the pre-arm relay.

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... Computer Minus 50 VDC Power Supply Measuremen. (I543V)

This is a critical computer reference voltage. A fluctuation in this voltage may cause additional digits to be added or dropped in the computer.

13. Miscellaneous Environmental and Power Supply Measurements

Several environmental and power supply measurements are also provided. Gyr^ temperature measurements (I531T, I532T) are perhaps the most significant of the environmental measurements. The gyro roter assembly is immersed in a fluid which, when heated to the proper temperature, holds the assembly in neutral buoyancy. If the temperature varies, the resulting torque may cause excessive gyro drift. One temperature measurement is taken on each gyro.

Temperature measurement of the binnacle (I533T) the computer (I535T) and the Analog Signal Converter (I534T) are ambient temperature measurements. All measurement instrumentation for the foregoing are physically located internally within the "containers" of the units.

Vibration measurements are made along the X, Y and Z axis of the platform, the control unit and the computer. These are discussed under Airframe Instrumentation Section.

The binnacle pressure measurement (I572P) is taken to verify that pressure within the platform housing (sphere) remains approximately constant, at 20 Hz after launch. Measuring instrumentation is installed in a boss located on the outside of the platform housing sphere.

In addition to the critical minus 50 volt power supply described previously the following power supplies are monitored via telemetry:

- a. Control 115 volt AC phase B (1540V). This is a measurement of phase B of the Convair supplied 115V AC power.
- b. Control minus 22.5 voltage (I541V).
- c. Computer minus 16.5, minus 10, plus 4, and plus 38 volt power supplies (I544V, I545V, I547V, I548V).

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14. Guidance Landline Measurements

For checkout and pre-launch test purposes many of the guidance measurements are provided via the landline system. This eliminates the necessity of telemetry support for these checks and pre-launch tests. It also provides a record for post-test comparison with measurements of inflight performance. The following is a list of functions to be recorded on magnetic tape:

TAPE TRACK	RACK MEAS. NO. DESCRIFTION		.
1	11603X	WORD GATE FIVE	
2	I1604X	MULT GATE SIX	
3	I1605X	112 CPS GATE	
4		50 KC	
5		100 KC	
6		100 KC	
7		TIMING, VOICE, SPEEDLOCK	
8		DIGITAL CHANNEL *	
9	I1515A	ACCELEROMETER X F1	
10	I1518A	ACCELEROMETER X F2	
11	I1517A	ACCELEROMETER Z F1	
12	I1520A	ACCELEROMETER Z F2	
13	I1516A	ACCELEROMETER Y F1	
14	I1519A	ACCELEROMETER Y F2	

* Digital Channel includes the following measurements:

I1505H	COMPUTER POSITION X	11502L	COMPUTER VELOCITY X
I1506H	COMPUTER POSITION Y	11503L	COMPUTER VELOCITY Y
I1507H	COMPUTER POSITION Z	I1504L	COMPUTER VELOCITY Z

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I1508H

RANGE ERROR FUNCTION

I1510W

ELAPSED TIME

I1509H

AZM FRROR FUNCTION

The format of this channel is shown on the Inertial Guidance Digital Word Structure illustration (see list of illustrations).

In addition to the measurements recorded on magnetic tape nine guidance measurements are recorded on an 8-channel Sanborn recorder according to the following format.

RECORDER CHANNEL	MEAS. NO.	DESCRIPTION
1	I1591C	PITCI GYRO TORQUE
2	I1592C	ROLL GYRO PORQUE
3	I1593C	YAW GYRO TORQUE
4	I1594D	PENDULUM #1 NULL
5	I1595D	PENDULUM #2 NULL
6	I1596D	OPTIC SIGNAL
7		EVENTS *
8		400 CPS REFERENCE

* Events include the following:

11521X VERN ENGINE COF SIG

11522X S ENGINE COF SIG

11570X STAGING SIGNAL

IV. SUPPORTING SYSTEMS MEASUREMENTS

A. Main Tank Pressurization

During flight, the missileborne propellant tank pressurization system serves to maintain the structural integrity of the airframe, and to furnish head pressure thus assuring propellant flow to the turbopumps.

Helium usage rates and distribution will be determined on several E series flight articles for design information. The temperature (F247T) and pressure

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(F246P, F260P) of the helium in the supply bottles will be measured to permit calculation of the mass of gas expended. Calibrated orifices will be inserted in the fuel and LO₂ tank pressurization lines. If the differential pressures across the orifices (F34P, F147P), and the pressure (F212P, F65P) and temperature (F17T, F146T) of the helium going into the orifices are known, then the helium flow rate to each propellant tank can be determined.

The behavior of the main tank pressurization regulators will be extensively examined conthe first five E series flight missiles for correlation with the flight environment, design requirements, and captive missile test results. The state of the helium at the regulator inlets will be established by the LO₂ tank pressurization regulator inlet pressure (F114P) and temperature (F115T) measurements. Actual regulator performance will be revealed by the pressurization line orifice differential pressure (F34P, F147P) and background pressure (F212P, F65P), and main tank ullage pressure (F1P, F3P) instrumentation.

The helium heat exchanger performance will be monitored on the first five flight missiles for comparison with helium usage and captive test data. The temperature change effected in the helium when passing through the heat exchanger will be established by the supply bottle (F247T) and LO₂ regulator inlet (F115T) temperature measurements.

Finally, the main tank ullage pressures (F1P. F3P) will be monitored on all vehicles as they are the end results of the missile tank pressurization system.

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B. Hydraulic System

Extensive hydraulic system analysis in support of the E flights will have been made from analog computer studies and captive missile testing. Instrumentation on the flight missiles will be limited to measurements for verifying adequate hydraulic system performance and to indicate any possible malfunction, should such occur.

Pressure measurements in each system (H140P and H33P) have been strategically located to reflect any major pressure fluctuations in either hydraulic system. Measurements of guidance command signals, resulting engine position measurements and hydraulic system pressures will verify the above studies. Should flight environment introduce unpredicted conditions in the hydraulic system, this will also be apparent from these fundamental measurements.

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Since the booster and sustainer hydraulic pumps are mechanically geared to the main engine turbines, pump speeds can be computed from P84F and P349B. These measurements in conjunction with the previously mentioned pressure measurements will verify proper power inputs to the system.

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The ability of the propellant utilization and head suppression valves to respond to their command signals will verify the adequacy of the sustainer engine hydraulic controls.

C. Electrical Power Supply

On "E" series missiles, airborne electrical power will be provided from a remotely activated primary battery. The battery is filled with acid from a container ruptured by a remotely generated signal, and is capable of remaining usable in this activated condition for several weeks, providing no power drain is placed on it.

Missile AC power will be provided from either a Bendix or Leland rotary inverter as on previous "D" series missiles. In either case the inverter will be supplied by the 28V main missile battery.

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The AC and DC power from the battery-inverter is routed first to the power distribution box and from there is distributed to the various missile systems. AC frequency (E50Q), three phases of AC voltage, and DC voltage (E28V) are picked up for telemetering from the missile system side of the motor driven switching assembly of the power distribution box. Phase A and phase C AC voltage are measured by E51V and E53V, respectively. Phase B voltage is instrumented and conditioned by ARMA as I540V CONTROL 115 Phase B. All three signals are conditioned to limit the instrumented range and thereby expand the measurement scale. Three phases are being monitored to assist in evaluation of the ARMA inertial guidance system, and the static inverter, should it be incorporated on later "E" series missiles. Current measurements are not planned since the electrical loads are known from systems testing and the currents may be calculated knowing the voltage.

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D. Tracking and Command Systems

1. Azusa

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a. Functional Description

Azusa is an all-weather, electronic tracking system which includes ground transmitting and receiving units, data handling and indicating equipment, a servo-directed antenna system, and an airborne transponder located in the missile. Tracking data is provided by the system in the form of two direction cosines and range, available either as three shaft positions or in digital form suitable for immediate use and/or storage on magnetic tape. Presently, this system, in conjunction with the IBM 709 computer, is the primary range system for providing impact prediction information for range safety purposes.

Briefly, the principle of operation is that successive trajectory positions of the airborne transponder are determined by continuously comparing the phase difference between microwave signals transmitted to the transponder from the ground station, and the retransmittal of these signals to the ground from the transponder.

The instrumentation provided on this system is designed to enable continuing investigation of the radio wave propagation effects and airborne antenna characteristics. Used in conjunction with information recorded at the ground station, over-all system operation can be evaluated with the instrumentation described in the following paragraphs.

b. Klystron Power Output (Z2E)

The klystron produces a 5000 MC output which is mixed with the 5000.194 MC input signal in the crystal mixer to produce a 60.194 MC IF signal. The crystal current is proportional to the klystron power output and is telemetered to verify that the klystron produces enough power output to assure proper tracking over the specified range.

c. Transponder RF Input/AGC (Z3E)

An AGC (automatic gain control) voltage, generated from the input signal to the limiter, is fed back to the grids of the RF amplifier stages. This is a negative voltage proportional to the amplitude of the signal from the IF amplifier. Its function is to adjust the gain of the RF amplifier stage in a manner which holds the IF amplifier output constant in amplitude regardless of changes in power of the received signal.

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Since this voltage is proportional to the output of the IF amplifier, it is also proportional to the power of the RF input signal to the transponder. Measurement of the ACC voltage (Z3E) is a convenient and conventional method of measuring received power level.

13

2. Mod III E Trajectory Instrumentation System

a. Description

This system is basically an adaption of the GE Mod III guidance system to AIG tracking purpose. The airborne portion consists of a rate beacon, a pulse bea on, common antenna, and associated waveguide including low-pass and high pass filters. This subsystem operates in conjunction with related Mod of ground equipment to perform instantaneous position and rate measuring functions for impact prediction. The Mod LIE Trajectory Instrumentation System will be installed on flight missiles only. No captive testing is planned.

b Rale and Pulse Boscon AGC (G579V and G503V)

(B)

(B)

automati : main control (AGC) circuit is utilized in the IF sections of the pilse beacon and the rate beacon. AGC voltages are generated in these circuits which are negative signals proportional to the strength of the signals being received by the IF amplifiers. Measurements of one of the two rate beacon AGC's (G579V) and the pulse beacon AGC (G503V) will be telemetered for post-test analysis. Although these measurements are useful in determining receiver operation, their main value lies in permitting the investigation of radio wave propagation effects and airborne antenna characteristics. This investigation consists of comparing the power of the signal sent from the ground with the power of the signal at the airborne transponders. For this reason, the AGC voltage measurements are calibrated directly in terms of transponder power input rather than in terms of voltage.

c. Rate Beacon Power Output (G582V)

(B)

A crystal is inserted in the rate beacon hybrid coupler which produces a voltage proportional to the power of the cutput signals from the rate beacon. This measurement is used for over-all rate beacon performance evaluation and, as in the case of the AGC measurements, for radio wave propagation effects and antenna characteristics.

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d. Pulse Beacon Magnetron Current (G504C)

The pulse beacon magnetron current is proportional to the duration, rate, and amplitude of the pulses transmitted from the beacon. The current is measured by the voltage drop in a section of the magnetron cathode resistor. Since the magnetron transmits pulses, the voltage drop is integrated to make it compatible to telemetry. This measurement along with the pulse beacon AGC measurement will provide the basic information required for post-test analysis of over-all pulse beacon performance.

e. Additional Data

In addition to the instrumentation provided via the telemetering system, parameters instrumented at the Mod III ground station reflect system performance. (See the range data section of the report for more detail.) Of greatest importance to over-all system performance evaluation are the Mod III ground station computed missile position, velocity and impact point data. This data when compared with other appropriate trajectory data will indicate how adequately this system performs its designed function.

3. Strobe Light System

A strobe light system is planned for F R&D series missiles for the purpose of providing an optical tracking aid. The strobe light system is housed in a single package which contains a strobe lamp, associated electronics, and a remotely activated "one shot" primary battery. On E R&D missiles the system is mounted on the forward fairing of the P-2 pod. System activation is initiated by the autopilot programmer at sustainer cutoff, after which time high intensity light flashes are emitted at half-second time intervals until depletion of ballery power.

Upon receipt of the activate command, the system also provides a continuous 28 VDC signal to a telemetry relay which switches telemetry channel E from a commutated source to the strobe light system signal source. Each time the strobe lamp flashes a 5 volt square wave pulse (M78X) is provided to the telemetry system to provide the timing correlation necessary for ballistic camera data reduction. The flash duration is 1.0 milliseconds with a peaking time of 0.1 milliseconds.

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The ballistic camera system used in conjunction with the strobe light is described in section 4-II. F. 2, Trajectory Instrumentation.

Battery Activation is accomplished from the blockhouse prior to launch. One of the countdown requirements is to determine that the strobe light battery reached full power potential (26-30 VDC) within 20 seconds after activation. MM144V, strobe light battery, a panel meter on the RF system console is used to indicate satisfactory activation of the battery.

4. Range Safety Command System

The function of the airborne Range Safety Command (RSC) system is to receive and detect coded RF signals from a ground control station and to cause appropriate engine cutoff action or explosive destruction of the missile when so commanded.

The RSC system is composed of a ground station, two receiving antennas connected through a coupler, two command sets (either of which will operate on the signal from either antenna), an arming switch and a destruct unit. Upon initiation of a manual fuel cutoff command, an automatic fuel command signal transmitted from the ground is frequency medulated by a combination of frequencies. The airborne command sets receive this signal and detect the modulating frequencies. A relay logic circuit decodes the information and provides a 28 VDC output to the destructor and/or the engine relay box.

a. #1 RSC RF Input/AGC (D7V)

The automatic gain control voltage generated from the output of the second IF amplifier of the #1 receiver is used as a measure of the received signal strength. This is required to verify that the signal in the RSC receiver is strong enough to be properly detected. This is an aid to determining maximum safe operating range.

b. RSC Cutoff and Destruct Outputs (D1V and D3X)

The cutoff and destruct instrumentation is a measurement of RSC decoder (relay) operation. The destruct instrumentation (D3X) monitors the destruct relay position in either set. The cutoff

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instrumentation (DIV) for both receivers is tied together in a summing network to produce step deviations on the telemetry output sufficient to determine whether the signal was an automatic or manual fuel cutoff signal. The circuitry is designed so that a manual fuel cutoff signal will produce a 2.3 VDC output (46% of IBW) for telemetering and an automatic fuel cutoff signal will produce a 4.6 VDC (92% of IBW) signal for telemetering. In the event a destruct signal is generated by the RSC system. This output is also superimposed on the Pitch Rate Gyro Signal (S53R) on continuous channel 1.10 to provide a precise time of function occurrence.

5. Telemetry

The telemeters used on the WS107A-1 XSM-65E missiles are of the same design as those used on the past R&D missiles, and hence, a high degree of reliability has been obtained. For these reasons no measurements of the telemeter itself are planned. Evaluation will be performed from recordings of signal strength and center frequency, and from the quality of data received.

V. PAYLOAD INSTRUMENTATION

A. Re-Entry Vehicles

Instrumentation of the re-entry vehicles is the responsibility of the re-entry vehicle associate contractors. Likewise reduction, analysis, and reporting of data obtained on re-entry vehicle performance is also the responsibility of the re-entry vehicle associate contractors. Normally this data is of little significance in the analysis of the performance of the remainder of the Atlas missile. At times, however, when a complex problem arises, re-entry vehicle data can be of considerable value to Atlas missile test analysis. For this reason the following sections pertaining to re-entry vehicle instrumentation is presented for Convair personnel information purposes.

1. Atlas Monitored Signals (S248X, Y1X)

The re-entry vehicle contractor is responsible for separating the re-entry vehicle from the Atlas. Convair responsibility is to send a release signal to the re-entry vehicle which in turn initiates a separation routine.

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This signal is part of an autopilot programmer subroutine based on vernier cutoff. Instrumentation of this signal (S248X) is provided to verify that it is correctly sent.

On those missiles that carry an Avco re-entry vehicle, a microswitch will be installed on the adapter by Avco to indicate re-entry vehicle separation. The microswitch indication will be monitored (Y1X) by the Atlas telemetry system.

2. Avco Series IV FRV4-1

One telemetry transmitter is utilized in the Avco Series IV FRV4-1 reentry vehicle. The telemetry system is not activated until apogee. The following is a typical list of measurements, by sampling rate, transmitted by the telemeter. Further details may be obtained from Avco.

	AVCO					l
SAMPLING RATE	MEAS.	MEASUREMENT	RAN	GE		L
 (SPS)	NO.	DESCRIPTION	FROM	TO	UNITS	Ţ
						l
Continuous	F6135	LINEAR ACCELERATION Ayl	M 20	20	G	
Continuous	F6136	LINEAR ACCELERATION Azl	M20	20	G	
Continuous	F6269	ANGULAR RATE ABOUT Y-AXIS Q1	M30	30	D/S	
Continuous	F6271	ANGULAR RATE ABOUT Y-AXIS Q2	M720	720	D/S	
Continuous	F6270	ANGULAR RATE ABOUT Z-AXIS R1	M30	30	D/S	
Continuous	F6272	ANGULAR RATE ABOUT Z-AXIS R2	M720	720	D/S	
Continuous	F8340	CASSETTE EJECTION DETECTION				
Continuous	F2013	IMPACT FUZING SYSTEM 1 OUTPUT				
Continuous	F2014	IMPACT FUZING SYSTEM 2 OUTPUT				

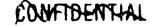
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SAMPLING RATE	MEAS.	MEASUREMENT	RAN	IGE	
(SPS)	NO.	DESCRIPTION	FROM	TO	UNIT
Continuous	F2015	WARHEAD DEFORMATION SIGNAL			
20	F2009	AIRBURST SIGNAL NO. 1			
20	F2010	AIRBURST SIGNAL NO. 2			
10	F6133	LINEAR ACCELERATION AX	M_0	10	G
10	F6134	LINEAR ACCELERATION AX2	M70	0	G
10	F6268	ANGULAR RATE ABOUT X-AXIS Pl	M720	720	D/S
10	F8245	NOSE, FORECONE, FORWARD PRESSURE (34.02, 40°)	1		
10	F8246	NOSE, FORECONE, MID PRESSURE (36.98, 68°)			
10	F8247	NOSE, BEHLID SHOULDER PRESSURE (41.84, 55°)			
10	F8248	CYLINDER, AFT PRESSURE (116.00, 55°)			
10	F8249	FLARE PRESSURE (125.50, 55°)			
10	F8250	FLARE PRESSURE (144.64, 55°)			
10	F8253	BASE PRESSURE			
10	F9149	STAGNATION POINT ABLATIO (21.78, 0°)	N		
10	F9150	SONIC POINT ABLATION (25.20, 13°)			
10	F9151	SONIC POINT ABLATION (25.20, 193°)			
10	F9152	TANGENT POINT ABLATION (30.12, 130°)			

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SAMPLING RATE	AVCO	MEAGUDEMENT	D 4 M	on.		
(SPS)	MEAS. NO.	MEASUREMENT DESCRIPTION	RAN FROM		UNITS	J
10	F9153	BEHIND SHOULDER ABLATION (41.46, 35°)				
10	F9154	BEHIND SHOULDER ABLATION (41.46, 125°)				
10	F9155	BEHIND SHOULDER ABLATION (41.46, 215°)				
10	F9156	BEHIND SHOULDER ABLATION (41.46, 305°)				
10	F9157	CYLINDER, AFT ABLATION (116.00, 35°)				
10	F9160	FLARE, AFT ABLATION (144.64, 35°)				
10	F8354	85% of 4. OV DERIVED FROM 29V SUPPLY, 40.0 KC SCO		3.4	VDC	⊕
10	F8336	0% CAL. PULSE, 40 KC SCO		GND		
10	F8314	50% CAL. PULSE, '7 KC SCO		2	VDC	
10	F8316	85% CAL. PULSE, 40 KC SCO		4.0	VDC	
٤	F2001	LOCKOUT SWITCH NO. 1				
5	F2002	LOCKOUT SWITCH NO. 2				
5	F2007	ARM DELAY NO. 1				
5	F2008	ARM DELAY NO. 2				
5	F3274.1	TANGENT POINT TEMP (30.12,	55°)			
5	F3275.1	TANGENT POINT TEMP (30.12,	145°)			
5	F3276.1	TANGENT POINT TEMP (30, 12,	230°)			
5	F3277.1	TANGENT POINT TEMP (30, 12,	325°)			
5	F3282	FLARE TEMPERATURE (125, 72	. 42°)			
5	F3283	FLARE TEMPERATURE (125, 72,	42°)			

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SAMPLING RATE (SPS)	AVCO MEAS. NO.	MEASUREMENT DESCRIPTION	RANG FROM	GE TO	UNITS
5	F8347	REF. JUNCTION TEMP. (FORWARD)			
5	F8348	REF. JUNCTION TEMP. (AFT)			
5	F8337	0% CAL. PULSE 22 KC SCO		GND	
5	F8349	39% CAL. PULSE 22 KC SCO		20	MV
5	F8350	66% CAL. PULSE 22 KC SCO		34	MV
5	F8351	100% OF 4.0 V SUPPLY 22 KC SCO		4.0	VDC
2	F2005	BATTERY VOLTAGE NO. 1			
2	F2006	BATTERY VOLTAGE NO. 2			
2	F2011	IMPACT FUZING SYSTEM 1 MONITOR			
2	F2012	IMPACT FUZING SYSTEM 2 MONITOR			
2	F8251	FIN NO. 1 PORT PRESS. (144.32, 176°30')			
2	F8252	FIN NO. 1 STB'D PRESS. (144.52, 183°30')			
1	F0016	PHYSICAL SEPARATION	OFF	ON	
1	F2003	ANA BATTERY NO. 1 MONITOR			
1	F2004	ANA BATTERY NO. 2 MONITOR			
1	F3 255	NOSE, SONIC POINT TEMP. (25.24, 232°)			
1	F3256	NOSE, TANGENT POINT TEMP (30.82, 45°)	F		

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SAMPLING RATE	AVCO MEAS.	MEASUREMENT	RAN	GE	
(SPS)	NO.	DESCRIPTION	FROM	то	UNITS
1	. 3257	CYLINDER, FORWARD TEMP. (44.60, 45°)			
1	F3258	CYLINDER, FORWARD TEMP. (44.60, 135°)			
1	F3259	CYLINDER, FORWARD, TEMP (44.60, 225°)			
1	F3260	CYLINDER, FORWARD TEMP. (44.60, 315°)			
1	F3261	CYLINDER, MID TEMP. (92.00,	45°)		
1	F3262	CYLINDER, MID TEMP (92.00,	135°)		
1	F3263	CYLINDER, MID TEMP. (92.00,	215°)		
1	F3264	CYLINDER, MID TEMP. (92.00	, 315°)		
i	F3265	CYLINDER, AFT TEMP. (116.0	00, 45°)		
1	F3266	CYLINDER, AFT TEMP. (116.)	00, 225°)	
1	F3267	FLARE, MID TEMP. (130.23,	225°)		
1	F3268	FLARE, AFT TEMP. (144.74,	45°)		
1	F3268	BASE (AFT DOOR) TEMP.			
1	F3270	NOSE COMPARTMENT TEMP. (26, 88, 225°)			
1	F3271	NOSE CON. PARTMENT TEMP. (37, 20, 225°)			
1	F3272	NOSE COMPARTMENT TEMP. (125, 72, 225')			
1	F3273	NOSE COMPARTMENT TEMP. (130, 40 - 55°)			
l	F8328	CASSETTA EJECTION SIGNAL			
1	F8329	CASSETTE F'ECTION DETECT	TON		

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SAMPLING RATE (SPS)	AVCO MEAS. NO.	MEASUREMENT DESCRIPTION	RAN FROM	GE TO	UNITS
1	F9158	CYLINDER, AFT ABLATION (116.00, C15°)			i
1	F9159	FLARE, FORWARD ABLATION (125.72, 215°)			
1	F9161	I'IN NO. 1 ABLATION (145.10,	0°)		
1	F9162	FIN NO. 2 ABLATION (145.10,	180°)		
1	F9163	BASE (AFT DOOR) ABLATION			
1	F8341	1.7 KC CONT. CHANNEL CAL.		4.0	VDC
1	F8342	2.3 KC CONT. CHANNEL CAL.		4.0	VDC
1	F8343	3.0 KC CONT. CHANNEL CAL.		4.0	VDC
1	F8344	3.9 KC CONT. CHANNEL CAL.		4.0	VDC
1	F8345	5.4 KC CONT. CHANNEL CAL.		4.0	VDC
1	F8346	10.5 KC CONT. CHANNEL CAL.		4.0	VDC
1	F8319. 2	85% OF 4.0 V DERIVED FROM 29V SUPPLY, 14.5 KC SCO		3.4	VDC
1	F8338	0% CAL. PULSE, 14.5 KC SCO		GND	
1	F8321	50% CAL. PULSE, 14.5 KC SCC)	2.0	VDC
1	F8320	85% CAL. PULSE, 14.5 KC SCO		3.4	VDC

1 F8324 85% CAL. PULSE, 7.35 KC SCO 3.4 VDC

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F8323.2

F8339

F8325

85% OF 4.0 V DERIVED FROM

0% CAL. PULSE, 7.35 KC SCO

50% CAL. PULSE, 7.35 KC SCO

29V SUPPLY, 7.35 KC SCO

3.4

GND

2.0

VDC

VDC



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3. Avco Series IV FRV4-2

On FRV4-2 re-entry vehicles Sandia will provide the telemetry system. This system includes two transmitters, both activated prior to launch. The following is a typical list of Avco measurements, by sampling rate, transmitted by the telemetry system. Sandia information is not available at this time. Further details may be obtained from Avco.

SAMPLING RATE	AVCO MEAS.	MEASUREMENT	RAN	VCE		
 (SPS)	NO.	DESCRIPTION	FROM	TO	UNITS	
Continuous	F2013	IMPACT FUZING SYSTEM 1 OUTPUT				
Continuous	F2014	IMPACT FUZING SYSTEM				
		2 OUTPUT				
Continuous	F2015	WARHEAD DEFORMATION SIGNAL				
Continuous	F8340	CASSETTE EJECTION DETECTION				
60	F6135	LINEAR ACCELERATION Ay1	M20	20	G	
60	F6136	LINEAR ACCELERATION Az1	M20	20	G	
60	F6269	ANGULAR RATE ABOUT Y-AXIS Q1	M30	30	D/S	Œ
60	F6271	ANGULAR RATE ABOUT Y-AXIS Q2	M720	720	D/S	
69	F6270	ANGULAR RATE ABOUT Z-AXIS R1	M30	30	D/S	
60	F6272	ANGULAR RATE ABOUT Z-AXIS R2	M720	720	D/S	
20	F2009	AIRBURST SIGNAL NO. 1				
20	F2010	AIRBURST SIGNAL NO. 2				
						i

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SAMPLING RATE	AVCO MEAS	MEASUREMENT	RAN		
(SPS)	<u> </u>	DESCRIPTION	FROM	TO	UNITS
10	F6132	LINEAR ACCELERATION	M10	10	G
10	F6134	LINEAR ACCELERATION Ax2	M70	0	G
10	F6268	ANGULAR RATE ABOUT X-AXIS P1	M720	720	D/S
5	F3274	TANGENT POINT TEMP. (30.12, 55°)			
5	F3275	TANGENT POINT TEMP. (30.12, 145°)			
5	F3276	TANGENT POINT TEMP. (30.12, 235°)			
5	F3277	TANGENT POINT TEMP. (30.12, 325°)			
5	F3278	CYLINDER, FWD TEMP. (44.60, 55°)			
5	F3279	CYLINDER, FWD TEMP. (44.60, 145°)			
5	F3280	CYLINDER, FWD TEMP. (44.60, 235°)			
5	F3081	GYLINDER, FWD TEMP. (44.60, 325°)			
5	F3282	FLARE TEMP. (125.72, 42°)			
5	F3283	FLARE TEMP. (125.72, 42°)			
5	F8245	NOSE, FORECONE, FWD PRE (34.02, 40°)	SS		
5	F8246	NOSE, FORECONE, MID PRES (36.98, 68°)	SS		
5	F8247	NOSE, BEHIND SHOULDER PH (41.84, 55°)	RESS		

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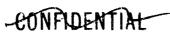
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SAMPLING RATE	AVCO MEAS.	MEASUREMENT	RAN	GE	1	
(SPS)	NO.	DESCRIPTION	FROM		UNITS	
5	F8248	CYLINDER, AFT PRESS (116.00, 55°)				
5	F8249	FLARE PRESS (125.50, 55°)				
5	F8250	FLARE PRESS (144.64, 55°)				
5	F8251	FIN NO. 1, PORT PRESS (144.32, 176° 30')				
5	F8252	FIN NO. 2, STB'D PRESS (144.32, 183° 30')				
5	F9149	STAGNATION POINT ABLATION (21.78, 0°)	1			
5	F9150	SONIC POINT ABLATION (25.20, 13°)				- -(
5	F9151	SOLIC POINT ABLATION (25.20, 193°)				
5	F9152	TANGENT POINT ABLATION (30.12, 130°)				
5	F9153	BEHIND SHOULDER ABLATION (41.46, 35°)				
5	F9154	BEHIND SHOULDER ABLATION (41.46, 125°)				
5	F9155	BEHIND SHOULDER ABLATION (41.46, 215°)				
5	F9156	BEHIND SHOULDER ABLATION (41.46, 305°)				
5	F9159	FLARE, FORWARD ABLATION (125.72, 215°)				
5	F9160	FLARE, AFT ABLATION (144.6	4, 35°)]	
5	F'9161	FIN NO. 1 ABLATION (145.10,	0°)			
5	F9162	FIN NO. 2 ABLATION (145.10,	180°)			

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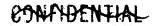
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SAMPLING RATE (SPS)	AVCO MEAS. NO.	MEASUREMENT DESCRIPTION	RAN FROM	GE TO	UNITS
2	F0014	GOOD GUIDANCE SIGNAL	OFF	ON	
2	F0015	SEPARATION SIGNAL	OFF	ON	
2	F2005	BATTERY VOLTAGE NO. 1			
2	F2006	BATTERY VOLTAGE NO. 2			
2	F2011	IMPACT FUZI: 3 SYSTEM 1 MONITOR			
2	F2012	IMP/ T FUZING SYSTEM 2 MONITOR			
1	F0016	PHTSICAL SEPARA ION	OFF	O1	
1	F2001	LOCKOUT SWITCH NO. 1			
1	F2002	LOCKOUT SWITCH NO. 2			
1	F2003	ANA BATTERY NO. 1 MONITOR			
1	F2004	ANA BATTERY NO. 2 MONITOR			
1	F2007	ARM DELAY NO. 1			
1	F2008	ARM DELAY NO. 2			
i.	F325 5	NOSE, SONIC POINT TEMP. (25, 24, 232°)			
1	F3256	NOSE, TANGENT POINT TEMP (30, 82, 45°)	.		
1	F3257	CYLINDER, FORWARD TEMP. (44.60, 45°)			
1	F3258	CYLINDER, FORWARD TEMP. (44.60, 135)			
1	F3259	CYLINDER, FORWARD TEMP. (44.60, 225°)			
1	73260	CYLINDER, FORWARD TEMP. (44.60, 315°)			

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	AVCO				
SAMPLING RATE	MEAS.	MEASUREMENT	RAN	IGE	
(SPS)	NO.	DESCRIPTION	FROM	ТО	UNITS
1	F3284	CYLINDER, AFT TEMP. (116.00, 135°)			
1	F3285	CYLINDER, AFT TEMP. (116.00, 315°)			
1	F3265	CYLINDER, AFT TEMP. (116.00, 45°)			
1	F3266	CYLINDER, AFT TEMP. (116.00, 225°)			
ī	F3267	FLARE, MID TEMP. (130.23, 225°)			
1	F3268	FLARE, AFT TEMP. (144.74, 45°)			
1	F3269	BASE, (AFT DOOR) TEMP.			
1	F3270	NOSE COMPARTMENT TEMP. (26.88, 225°)	٠.		
1	F3271	NOSE COMPARTMENT TEMP. (37.20, 225°)			
1	F3272	AFT COMPARTMENT TEMP. (125.72, 225°)			
i	F3273	AFT COMPARTMENT TEMP. (130.40, 55°)			
1	F8253	BASE, (AFT DOOR) PRESS			
1	F8347	REF. JUNCTION TEMP. (FORW	WARD)		
1	F8348	REF. JUNCTION TEMP. (AFT)			
1	F8329	CASSETTE EJECTION DETECT	ION		
1	F9163	BASE, (AFT DOOR) ABLATION			

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MEASURE	EMENT CODE	NUMBER OF MEASUREMENTS (Avco)		
MEAS. NO.	DESCRIPTION	FRV4-1	FRV4-2	
F0000	SEPARATION SIGNAL	1	3	
F2000	ARMING AND FUZING SIGNALS	15	15	
F3000	TEMPERATURES			
	Heat-Shield Structure Interface	15	13	
	Compartment Temperatures Material Temperatures	4 4	4 8	
	Surface Temperatures	2	2	
F6000	DYNAMIC MEASUREMENTS	9	9	
F8200	PRESSURES	9	9	
F8300	INSTRUMENTATION FUNCTIONS	27	4	
F9000	ABLATION	15	13	
	TOTAL	101	80	

4. Avco Series IV FRV4-3

The FRV4-3 re-entry vehicles will be systems engineering vehicles. A system evaluation type instrumentation program will be conducted. Information concerning this program is not presently available to Convair.

 $^{f B}$

5. GE Mark III Mod I

Two (2) telemetry transmitters, one transmitting a time delayed recording of the other's output, are utilized in the GE Mark III Mod I Re-entry Vehicle. The following is a typical list of measurements, by telemetry channel, transmitted by the two telemeters. Further details can be obtained from General Electric.

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Telemetry Channel	COMMUTATOR	MEASUREMENT	RAI	NGE	
(IRIG)	SEGMENT	DESCRIPTION	FROM	то	UNITS
6		ROLL RATE	M300	300	D/S
7		PITCH ACCELERATION @ C. G.	M45	45	G
8		YAW ACCELERATION @ C. G.	M45	45	G
9		YAW RATE	M600	600	D/S
10		PITCH RATE	M600	600	D/S
11		YAW ACCELERATION @ NOSE	M45	45	G
12		PITCH ACCELER. TION @ NOSE	M45	45	G
13		SANDIA WARHEAD DATA			
14		SANDIA WARHEAD DATA			
15		SANDIA WARHEAD DATA			
16		SANDIA WARHEAD DATA			
E	0	90 x 10 COMMUTATOR			
	1	10% CALIBRATION-28 VDC BATTE	RY		
	2	100% CALIBRATION-28 VDC BATT	ERY		
	3	100% CALIBRATION-5 VDC XDCR	SUPPLY		
•	4	50% CALIBRATION-2.5 VDC XDCR	SUPPLY		
	5	10% CALIBRATION-0.5 VDC XDCR	SUPPLY		
	6	50% CALIBRATION-INSTRUMENTA	IOM NOIT	VITOR	
	7	PRESSURE NO. 1			
	8	PRESSURE NO. 2			
	9	PRESSURE NO. 3			
	10	PRESSURE NO. 4			
	11	PRESSURE NO. 5			
E	12	PRESSURE NO. 6			
	13	PRESSURE NO. 7			
	14	PRESSURE NO. 8			
	15	PRESSURE NO. 9			
	16	PRESSURE NO. 10			
	17	PILESSURE NO. 11			
	18	PRESSURE NO. 12			
	19	PRESSURE NO. 13			
	20	PREARM LOCKOUT, PRESSURE SI FRANGIBLE PATCH NO. 1, NO. 2	•		
	21	DATA CORRELATOR			
	22	ARM NO. 2, MOTOR CLUTCH NO. CURRENT PROGRAMMER NO. 2	2,		
	23	FUZE NO. 2, BATTERY NO. 2			

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IRIG) E	24 25 26	DESCRIPTION FUZE NO. 1, BATTERY NO. 1 SOUND PRESSURE LEVEL NO. 2 (300 CPS to 10 KC)	FROM	то	UNIT
E	25 26	SOUND PRESSURE LEVEL NO. 2	120		
	26	SOUND PRESSURE LEVEL NO. 2	120		
		(300 CPS to 10 KC)		160	db
	0.5	VIBRATION NO. 1	M 5	5	G
	27	VIBRATION NO. 2	M5	5	G
	28	SOUND PRESSURE LEVEL NO. 1	120	150	db
	-	(300 CPS to 10 KC)			
	29	ARM NO. 1, MOTOR CLUTCH NO.			
	_•	1, CURRENT PROGRAMMER NO. 1			
	30	LONGITUDINAL ACCELERATION,	M10	0	G
		FINE	1/110	·	Ü
	31	SOUND PRESSURE LEVEL NO. 2	120	160	ďb
		(10 KC to INFINITE)		200	u.
	32	INTERNAL TEMPERATURE NO. 1	0	200	DGF
	33	INTERNAL TEMPERATURE NO. 2	0	200	DGF
	34	SOUND PRESSURE LEVEL NO. 1	120	160	qp .
	V.	(10 KC to INFINITE)	120	100	ab
	35	INTERNAL PRESSURE	0	30	PSIA
	36	50% CALIBRATION, INSTRU-	v		1 01/1
	00	MENTATION MONITOR			
	37	PRESSURE NO. 1			
	38	PRESSURE NO. 2			
	3 9	PRESSURE NO. 3			
	40	ARLATION NO. 1			
	41	ABLATION NO. 2			
	42	ABLATION NO. 3			
	43	ABLATION NO. 4			
	44	ABLATION NO. 5			
	45	ABLATION NO. 6			
	46	ABLATION NO. 7			
	47	ABLATION NO. 8			
	48	ABLATION NO. 10			
	49	ABLATION NO. 10			
	50	ABLATION NO. 11	2410	^	
	51	LONGITUDINAL ACCELERATION,	M10	0	G
	52	FINE ABLATION NO. 13			

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Channel	COMMUTATOR	MEASUREMENT	RAN	IGE	
ЛRIG)	SEGMENT	DESCRIPTION	FROM	то	UNITS
E	53	ABLATION NO. 14			
_	54	ABLATION NO. 15			
	55	ABLATION NO. 16			
	56	ABLATION NO. 17			
	57	ABLATION NO. 18			
	58	ABLATION NO. 19			
	59	ABLATION NO. 20			
	60	ABLATION NO. 21			
	61	ABLATION NO. 22			
	6 2	A. LATION NO. 23			
	63	ABLATION NO. 12			
	64	LINER TEMPERATURE NO. 2			
	65	LINER TEMPERATURE NO. 3			
	66	50% CALIBRATION-INSTRUMENTAT	ION		
		MONITOR			
	67	PRESSURE NO. 1			
	68	PRESSURE NO. 2			
	69	PRESSURE NO. 3			
	70	LINER TEMPERATURE NO. 4			
	71	LINER TEMPERATURE NO. 5			
	72	LINER TEMPERATURE NO. 6			
	73	INFLIGHT SUPERVISION MONITOR			
	74	SHIELD TEMPERATURE NO. 1			
	75	SHIELD TEMPERATURE NO. 2			
	76	SHIELD TEMPERATURE NO. 3			
	77	SHIELD TEMPERATURE NO. 4			
	78	SHIELD TEMPFRATURE NO. 5			
	79	SHIF LD TEMPERATURE NO. 6			
	80	SHIELD TEMPERATURE NO. 7			
	81	50% CALIBRATION, INSTRUMENTA	TION		
		MONITOR			
	82	SHIELD TEMPERATURE NO. 9			
	83	LINER TEMPERATURE NO. 1			
	84	SHIELD TEMPERATURE NO. 8			
	85	50% CALIBRATION, INSTRUMENTA	TION		
		MONITOR			

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Telemetry Channel	COMMUTATOR	MEASUREMENT	RAI	NGE	
(IRIG)	SEGMENT	DESCRIPTION	FROM	то	UNITS
E	86	LONGITUDINAL ACCELERATION,	M75	0	G
	87	LONGITUDINAL ACCELERATION, FINE	M10	0	G
	88	SEPARATION EVENT			
	89	FRAME SYNC			
	90	FRAME SYNC			

6. GE Mark III Mod II

Description of the Mod II instrumentation is not currently available to Convair.

VI. GROUND SUPPORT EQUIPMENT MEASUREMENTS

A. Launcher

The "E" series launcher is designed for an entirely unrestrained launch of the missile. During FRF's four hold-down hooks are the only means of missile restraint. The hooks are mounted on a trapezoidally shaped frame which rotates upward 90° to engage the missile while the missile is in the horizontal position. Upon erection the bases of the hooks slip into place and are held securely in four pedestal assemblies on the ground. The pedestal assemblies support the weight of the missile in the erect position. To establish launcher integrity, the following measurements will be made on 3E.

1. Temperatures

Due to the structural differences between this launcher and the "D" launcher, and different aspiration ratios, temperatures of the pedestals will be a prime consideration. Temperature measurements will be taken on the side of the pedestal facing the engines (L1405T, L1407T).

Also, on the side facing the turbine exhausts, delta "T" measurements will be made across the plate (inside to outside of pedestal) to detect temperature difference which would cause warpage. (L1415T, L1416T).

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2. Strain

Static and dynamic loads in the hooks will be measured by strain gages on the smallest cross section (L1401S, L1402S).

3. Deflection

Position indicators (L1398D, L1399D) will determine separation at the disconnect panels at the time of firing, and detect amounts of settling on tanking.

B. Subcooled LO₂ Slug Transfer Unit

In order to avoid a prohibitive weight penalty, the missile LO₂ suction plumbing configuration satisfies the engine start transient requirements only when the engine starts with subcooled LO₂ at the booster turbopump inlets. Each subcooled LO₂ slug transfer unit will be validated at the launch site prior to any engine firings. The condition of the LO₂ entering and leaving the unit will be monitored by associated pressure (N1309P, N1310P) and temperature (N1313T, N1314T) instrumentation. A differential pressure measurement across a calibrated venturi (N 3301P), together with a pressure transducer in the storage tank ullage space (N1311P), will indicate the GN₂ flow rate and pressure in the unit. The valve positions (N1335X, N1336X, N1337X, N1338X, N1339X) will be monitored for trouble-shooting and failure analysis information. All the aforementioned instrumentation, except the GN₂ venturi differential pressure measurement (N3301P), will be monitored for operating and post test analysis purposes.

C. Propellant Loading System

The Convair propellant loading system consists of liquid level sensors which indicate propellant covering and uncovering. The four fuel probes are as follows:

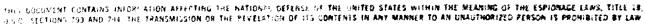
Fuel 95% Primary Control (U1207X) signals rapid fill shut-off.

Fue! 95% Secondary Control (U1206X) serves as a back-up to U1207X.

Fuel 100% Primary Control (U1205X) should give a covered indication.

Fuel 100% Secondary Control (U1204X) should give an uncovered indication.

Fuel is tanked between the 100% and over-fill probes.





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The four LO₂ probes are discussed below:

LO₂ 95% Rapid Load Shut-Off (U1203X) signals termination of rapid fill.

LO₂ Topping Low Control (U1202X) defines the lower limit of the topping band.

O₂ Topping High Control (U1201X) defines the upper limit of the topping band.

LO₂ 100% Slug Cutoff (U1200X) gives a covered indication during slug chilling, before boil-off causes it to uncover.

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(B)

DATA GATHERING SYSTEMS

I. INTERNAL DATA

A. Telemetry Systems

1. Atlas Telemetry System

u. General

The Atlas R&D telemetry subsystem utilized on WS107A-1, XSM-65E misisiles is the same as that provided for WS107A, XSM-65D AIG missile. Hence there will be three telemeters available for transmitting missile data.

b. Functional Description of Components

(1) Telemeter Package

Three telemeter packages are installed, each of which is a 16 channel FM/FM package, using Research Development Board (RDB) channels 1 through 13, A, C, and E. Each package contains a 35 watt r-f transmitter, frequency multiplexing network, five volt subcarrier oscillators, commutators, inflight calibrator for commutated signals, and a transverter to power the telemeter package using ground or missileborne supplied 28 volt DC. Plug in type concepts allow unused subcarrier oscillators, commutators and associated equipment to be removed from the telemeter package when not required.

(2) Accessory Package

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(3) Battery Package

Three remotely activated primary battery packages are utilized, one for each telemeter package. Each battery provides two power outputs, 28 and 7 volts, to the transverters in the telemeter packages and accessory package.

(4) Antenna

There are two telemetering antennas, one located in the forward end of each equipment pod. Each antenna is connected to one of the outputs of the ring coupler. Both antennas use a slot radiator. The basic pattern of the antennas, when mounted on the missile, approximates that of a loop antenna whose plane coincides with the plane defined by the roll and yaw axes.

In order to combine the outputs of the telemeter packages, a system of couplers is utilized. A diplex coupler combines the 35 watt outputs of two telemeter prekages into one 70 watt signal. A ring coupler combines the remaining 35 watt telemeter signal with the 70 watt signal from the diplex coupler, and divides the resultant 105 watt signal into two 52.5 watt signals which are routed to the antennas.

c. Atlas Telemeter Carcuits

The following is a brief explanation of circuits contained in the E R&D Series.

(1) Direct Input Channels

The first three channels of the telemeter system are of the direct input type. This means that the transducer or function to be measured generates the necessary frequency to modulate the 'ransmitter. The output of the various devices are set at the same level by a potentiometer and then fed through a band pass filter into a common mixing amplifier and amplified to the proper level to modulate the transmitter.

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(2) Continuous Channels

All other channels use voltage controlled oscillators. Continuous voltage controlled channels will be discussed first. On these channels only one measured function is applied to the subcarrier oscillator as opposed to commutated channels on which a variable number of inputs are applied to the subcarrier oscillator on a time sharing basis. The continuous channels have 0 to 5 volts sensitivity, voltage controlled oscillators with the exception of telemeter #2 channels 12 and 13 which use ± 2.5 volt oscillators.

The commutated samples are compared to the injected, highly accurate, calibration voltages. When these samples are superimposed on the information from the continuous channels, the entire channel is calibrated quite accurately. The commutated channel used for this purpose is Channel 11 on Telemeter #2. In addition to continuous direct input signals, the continuous channel subcarrier oscillators also carry "blip" event measurements for accurate time of occurrence determination. These events, such as sustainer and vernier engine cutoff, cause relay closures. These relay voltages are differentiated into blips and superimposed on the continuous data signal.

(3) Commutated Voltage Controlled Channels

Both the continuous and commutated voltage controlled oscillators may be classified as to their input stimulus range. With one exception, all the commutated channels have a standard input voltage range of -1.25 to + 5.0 volts. The voltage between 0 and 5.0 volts represents information. The 0 to -1.25 volt portion is a decommutation pedestal.

Channel 11 of Telemeter #1 has a -0.25 to +1.0 volt oscillator to handle low voltage information. The positive portion of the input voltage range represents information and the negative portion is the decommutation pedestal.

The commutated input circuits are somewhat complicated.

A brief description of each of these circuits is discussed below.

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(4) Positive Voltage Inputs

The information signal may be supplied from a potentiometer, some other 5 volt source or treme higher voltage. In the potentiometer type, the setting of the potentiometer, hence the voltage, is varied by a pressure for example. Other voltages from various places in the missile are brought to the commutator segments. Where voltages higher than 5 volts are to be measured, a voltage divider is formed between the three rings of the commutator to reduce the stimulus to a 0 to + 5 volt range. The input signals are applied to the odd numbered commutator segments. A negative voltage is applied to all the even numbered segments (except 56 and 58) as a decommutation pedestal. Calibration voltages are applied to segment 25 (100% calibration from transducer power supply), segment 27 (0% calibration), and segment 29 (50% calibration from the inflight calibrator). Segments 55 through 59 are used for the master pulse or frame sync and carry a 100% calibration signal from the inflight calibrator.

(B)

(5) Voltage and Temperature Measurements

Channel 11 of Telemeter #1 is unique in that the subcarrier oscillator range is -0.25 volts to +1.0 volts. A combination temperature, negative voltage and positive voltage circuit is used. This allows the limited number of temperature measurements to be made and still fully utilize the channel.

In the bridge circuit three inactive arms of the bridge are in the accessory package. The resistance of the active arm is 500 ohms, using the nominal resistance of the transducer at the low end of its temperature range. The transducers consist of platinum or nichrome resistors whose resistance changes by 100 ohms, that is from 500 to 600 ohms, over a prescribed temperature range. The bridge circuit is designed to give an output of 1.0 volt from the 100 ohm change. In flight calibration is achieved by substituting 500 and 600 ohms in the active arm of the bridge representing zero and 100% information.

These temperature calibrations are applied to segments 25 (100%, and 27 (0%).

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Positive voltage inputs to this channel are made in the same way previously discussed except that none of the voltages are derived from potentiometers. In this way the 100% level of the sync pulse may be used for calibration purposes. In addition, on this channel, segment 29 is 0% (missile ground). Negative voltages are biased to a positive value usable to the oscillator. The negative input voltage range is 0 to -2.4 volts. This is biased against +2.4 volts from the calibrator resulting in an output to the oscillator of 0 to +1.2 volts, which, when loaded with the oscillator input impedance is of the range 0 to +1.0 volt.

(6) Displacement Gyro Measurements

The outputs from the autopilot displacement gyros are conditioned (demodulated) by the displacement demodulator in the accessory package to 0 to +5.0 volts.

(7) Rate Gyro Measurements

The outputs from the autopilot rate gyros are demodulated by the rate demodulator in the accessory package. The outputs of the demodulator (0 to 5 volts) are applied directly to the subcarrier oscillators of Telemeter #1 channels 8, 9, and 10.

(8) Strobe Light Circuit

Previous to sustainer cutoff, channel C of Telemeter #1 is commutated. At sustainer cutoff, 28 volts is applied to relay K1 from the strobe light package and thus switches the subcarrier oscillator input to the strobe light output.

(9) Crystal Rectifier Unit

A crystal rectifier unit is located in the accessory package. In this unit the inverter voltages are conditioned for telemetering.

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RF #3			SCC	INPUT							2Λ	5V	5V		5V		5V	2V	5V	20	s are			
R R		COMMUTA-	TION	RATE							Continuous	Continuous	Continuous		2.5 RPS		Continuous	Continuous	Continuous	Continuous	T; frequencie		channels.	
RF #2			8CO	INPUT		Direct	5V	5V	5V	5V	2V	5V	5V	5V	5V			5V	2V	5V	1 DIREC		all other	
F		COMMUTA-	TION	RATE		Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	2.5 RPS			Continuous	Continuous	30 RPS	annels labelec		are used for	
RF #1			SCO	INPUT	Direct	Direct	Direct	5V	5V	5V	5V	5V	5V	5V	1.V	5V	5V	5	5V	5V	d for ch		illators	
		COMMUTA-	TION	RATE	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous	Continucus	Continuous	Continuous	Continuous	2.5 RPS	5 RPS	5 RPS	10 RPS	1/8 RPS	Digital	ators are use		ubcarrier osc	
	FREQUENCY	RESPONSE	FLAT TO 2%	CPS				0-14	0-20	0-25	0-35	0-45	0-59	0-81	0-110	0-160	0-220	099-0	0-1200	0-2100	No subcarriet oscillators are used for channels labeled DIRECT; frequencies are	generated externally.	Voltage controlled subcarrier oscillators are used for all other channels.	
		DEVIA-	TION	8€	±7.5	±7.5	±7.5	₹7.5	±7.5	#3. £	±7.5	±7.5	±7.5	±7.5	±7.5	±7.5	±7.5	±15	±15	±15	1. No su	gener	2. Volta	
		CENTER	FREQ.	C.PS	00 †	260	730	960	1,300	1,700	2,300	3,000	3,900	5,400	7,350	10,500	14,500	22,000	40,000	000'02	omments:			
				CHANNEL	-	7	က	4	လ	9	1.	œ	G	10	11	12	13	¥	ပ	ы	Additional Comments:			

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d. Utilization of the Atlas Telemetry System

For commutated voltages, channel assignments were made utilizing commutator speeds which will yield a minimum of four samples per cycle which is considered adequate to reconstruct the waveform. In some instances it was necessary to cross connect segments on a commutator to provide desired sampling rate.

A maximum of 27 information (plus sync pulse and 100% calibration using 2-1/2 segments) channels are available from each commutated channel with the exception of Channel C on RF#1. Of these 27 information channels 3 are used for calibration voltages, one of which may be used for the transducer power supply voltage (see commutation waveform illustration). A ground-based decommutator employing ground gating will be employed with all commutated channels with the exception of the channel mentioned. Each commutator wafer will employ 30 segment pairs.

Channel C of RF 11 is a vibration channel. The commutator used also employs 60 segments. The segment pattern (see commutation waveform illustration) consists of six groups of 7 segments tied together with a reference segment between each group. Calibrations of 100% and 0% along with a sync pulse and 100% calibration follow each set of six groups.

Channel C on RF #1 will be switched at sustainer cutoff to the high intensity strobe light system. The channel will be continuous, transmitting the pulses generated by the strobe light system. Special modifications to the telemeter packages have been made in order to transmit various ARMA measurements. A digital channel, RF #1 Channel E, has been incorporated for ARMA computer measurements, this channel is discussed in detail in a following section. Output filters on RF #3 Channels 13, C and E have been modified to pass the ARMA string frequency outputs. Channels C and E, must transmit up to 4800 cps and channel 13 up to 400 cps.

2. Payload Telemeters

a. Avco Series IV FRV4-1

The Avco Series IV FRV4-1 re-entry vehicle instrumentation system utilizes one FM/FM VHF transmitter. This transmitter operating a frequency of 252.4 MC, is not activated until apogee. It transmits real time

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data from this point, apogee, to impac. An airborne recorder is used to record the data during the blackout portion of re-entry when standard VHF signals become severely attenuated. The recorder is housed in an ejectable data cassette.

Eleven standard IRTWG subcarrier channels are employed, four of which are commutated. The other seven channels carry continuous data. The voltage range used to modulate the oscillators is zero to plus four volts DC for continuous channels except for channel 2 which is not deviated. The presence or absence of channel 2 indicates the data function. Commutated channels use a minus one volt level for decommutation purposes. The commutators contain 60 pins. The data signal assignments are by numbers 1 through 30, the decommutation segments are not numbered.

For calibration purposes data originates with transducers which fall into two categories: voltage-excited types (potentiometer or resistance network), and self-excited types (thermocouple or crystal pickup). Data from voltage-excited transducers require samples of the excitation voltage for calibration while an absolute voltage is required to calibrate the data from self-excited transducers. The regulated +4 volts supplied to the potentiometer-type pickups is also directed through a precision voltage divider to provide 50 and 85 percent calibration points as well as a common 0 percent calibration point. These voltages serve as reference points to calibrate the potentiometer-type transducers. Plus 3.4 volts, derived from the +29 voit supply by means of a voltage divider network, is utilized to obtain an 85 percent of full-scale calibration point for the resistance network-type sensors. The regulated +4 volts is also supplied to a divider which provides 0, 20, and 34 millivolt outputs as an absolute voltage calibration of the low-level thermocouple outputs.

The full-scale output of the thermocouples is 37 millivolts. All the calibration voltages are commutated on the same channel as those on which the data are being ralibrated. Transmission redundancy is utilized to provide a means of calibrating data which require continuous monitoring. To accomplish this, six dynamic transducers with potentiometer outputs are transmitted continuously as well as at one sample per second. Calibration is obtained by comparing a sample of the dynamic measurement on the commutated channel with the calibration pulses on that channel, and referencing the information obtained to the continuous channel.

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The Series IV FRV4-1 includes a C-band beacon for the purposes of obtaining terminal tracking data. The beacon is turnable over the frequency range of 5400 to 5900 MC with a minimum peak power output of 400 watts.

A non-ejectable Sofar bomb containing approximately 4 pounds of high explosives is mounted in the flare section for the purpose of obtaining impact location data.

b. Avco Series IV FRV4-2

The telemetry system for the Avco Series IV FRV4-2 re-entry is provided by Sandia and Avco. The instrumentation system utilizes two (2) FM/FM VHF transmitters. Both transmitters, designated A (252.4 MC) and B (255.1 MC), are activated prior to launch and transmit data until impact. As on the FRV4-1 vehicle an airborne recorder is used to record the data during the blackout portion of re-entry. The A package contains 13 subcarrier channels 4 of which are commutated. The B package contains 14 subcarrier channels 4 of which are commutated.

The instrumentation system similar to the FRVI-1 vehicle contains a C-band beacon and a Sofar bomb.

c. Avco Series IV FRV4-3

Description of the FRV4-3 vehicle instrumentation system is not presently available to Convair.

d. GE Mark III Mod I

The Mark III Mod I Re-entry vehicle R&D instrumentation system utilizes two (2) FM FM VHF transmitters. One transmitter, operating at a frequency of 244.3 MC, transmits real-time data from liftoff to impact. From 1 to 3 seconds after fuzing, the real-time transmitter is cleared for the Sandia Mod VI which is used to acquire impact data. The second transmitter, operating at a frequency of 237.8 MC, will continuously play back the mixed subcarrier signal from the storage recorder. The storage recorder, which is a continuous-loop type, will be on from liftoff to inipact and will continuously record and play back, the time delay can be varied by using tapes of various lengths.

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5 RPS 10 RPS 10 RPS 11 RPS

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COMMUTATION

RATE

CHANNEL

TLM 'B'

Continuous

Continuous

Continuous Continuous

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TILIZATIO	N OF AVCO SERIES I	UTILIZATION OF AVCO SERIES IV FRV41 & FRV4-2 TELEMETERS	CLEMETERS	
		FRV4-1	·	FRV
CENTER FHEQ CPS	DEVIATION L	COMMUTATION RATE	TLM 'A' COMMUTATION RATE	
	Not Deviated	Continuous	٧x	1
	17.5	Continuous	Y Z	
	:7.5	Continuous	Continuous	
	17.5	Continuous	Continuous	
	17.5	Continuous	Continuous	
	+7.5	Continuous	Continuous	
	17.5	1 RPS	Continuous	
	: 7.5	Continuous	Continuous	_
	+7.5	1 RPS	Continuous	_
	17.5	٧Z	Continuous	
	: 7.5	NA NA	5 RPS	
	17.5	٧×	10 RPS	
	17.5	NA	10 RPS	
	47.5	Y.V	10 RPS	
	±7.5	٧×	Continuous	
	115	5 RPS	Y Z	
	± 15	10 RPS	N.A.	

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The Mark III Mod I vehicle also includes a C-band beacon which can be used with the AN/FPS 16 radar. The beacon interrogation frequency is 5610 mc and the response frequency is 5675 mc. The beacon will operate from liftoff to impact. Two (2) Sofar bombs are included in the vehicle. Both are body mounted in the flare section and are non-ejectable.

e. GE Mark III Mod II

Description of the Mod II telemetry system is not presently available to Convair.

B. Landline Systems

1. General

The major areas which the complex 11 & 13 landline instrumentation systems will support are:

- a. Validation and checkout.
- b. Test and launch operations.
- c. Post test analysis.

2. Intent

The landline systems will provide visual indication and recordings in the block-houses of physical and electrical parameters originating in the ground support equipment, launch control, and the missiles. These systems will provide real time data on strip charts for post test analyses.

3. Recorder Types

a. Magnetic Tape

A magnetic tape recording system is used to provide accurate high response recordings. The tape recording capability at complexes 11 and 13 consists of 28 tracks of CEC tape recorders. Because signals are not multiplexed before recording and track 7 on each transport is used for

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speed-lock signal and timing code there are actually 26 tracks available for recording data. The response of the tracks range from 100 cycles to 100 kilocycles. At present the tape recorders are utilized solely for ARMA guidance data. See the discussion of guidance measurements for details on tape format.

b. Graphic Recorders

Graphic recorders have either one or two channels of information per recorder. The frequency response is low and therefore limited to recording information from slowly varying functions. Information is easily read in real time on graphic recorders due to data being projected over a wide area. The graphic is the primary recorder used for propulsion and pneumatic system red-line parameter display.

c. Oscillograph Recorders

Oscillographs are used to record functions requiring high frequency response but no real time display.

A photographic method of simultaneously recording up to 36 channels of information (with timing) or continuously moving light sensitive paper is employed. This method provides response to 2000 cps.

d. Sequence Recorders

In addition to analog and frequency measurement requirements, there are event type measurements. Esterline-Angus operations recorders will be used. These recorders will be used to monitor the activations and deactivations of various relays, switches and other types of sequence functions.

4. Recorder Capabilities

Channels of each recorder type at Complexes 11 and 13:

Graphic

64

Oscillograph

144

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Sequence

160

Magnetic

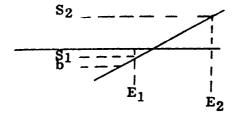
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C. Instrumentation Calibration

1. Landline

The calibration technique for instrumentation does away with the need for highly accurate calibration facilities at the test sites. The Standards Laboratory at Astronautics calibrates the transducers which convert the measurement sensed into an analog voltage equivalent. The information from the Standards Laboratory is supplied to Test Evaluation who determines the best straight line relationships (determined by a Least Squares Linear Fit) of the parameter being measured by the transducer and its electrical output. The linear relationship is expressed in slope intercept form and is transmitted to the test sites via IBM tabulations.

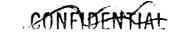
The following equation defines the slope intercept: y = mx + b



 S_1 and S_2 are parameters levels and E_1 and E_2 are corresponding transducer output levels.

Because
$$\frac{S_2 - S_1}{E_2 - E_1} = m$$
,

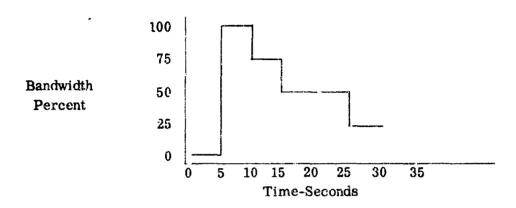
the slope of the calibration curve, any calibrated range can be established knowing m and the intercept b, and the related units (i. e., P.S. I. and volts, etc). For landline recorder calibration, and to determine recording system linearity, electrical signals are recorded on each channel just prior to test data. These signals establish a lower and upper limit of the recorder range. Input Calibration Networks are used to generate calibration signals, calculated from slope-intercept information.



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In addition to zero and 100% bandwidth signals, 75%, 50%, and 25% signals are normally recorded to establish linearity.

2. Telemetry

Calibration of telemetry data may be divided into two categories, voltage and transducer

For voltage measurements, accurate calibration levels must be generated for comparison with the data signal. The 100% level is always the commutator sync pulse level. 0% is missile ground.

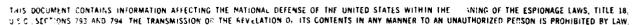
For measurements requiring transducers, the exitation voltage is required along with the slope intercept data for the transducer for accurate data reduction. 100% calibration is provided on one pin of each commutator.

II. TRACKING DATA

A. General

External tracking data will be obtained to supplement the internal data received from the Convair airborne telemetry system. This will assure a complete evaluation of missile flight performance.

Tracking data should be obtained continuously and recorded as functions of time, direction, and range from the tracking sites. This may be done directly in terms of angles and ranges or indirectly in the form of data requiring mathmetical t. atment to yield the desired position information. All tracking data will be referenced





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to a Cartesian coordinate system. The velocity of the vehicle may be determined from the tracking systems by means of frequency or range rate changes in the electronic systems, or by means of derivatives of the position data from any tracking system.

The type of tracking system data obtained during successive phases of any particular mission will depend on the capabilities of the vehicle instrumentation and of the existing equipment in the effective range area. The following sections present and briefly describe the more important data gathering systems which may be utilized in fulfilling the range requirements for this missile program.

Azusa Data

The Mark I system at Cape Canaveral is the only Azusa tracking site operational at the present time. This is expected to be replaced by the Mark II system by mid-1960. The range of the Mark II system using B-1 coherent transponder is believed to be approximately 1000 nautical miles.

The Azusa system provides data for determination of the position and velocity of the Azusa airborne transponder. Position measurements are expressed in terms of two direction cosines of the transponder with respect to each of two perpendicular horizontal coordinate axes. Range to the transponder is measured from the origin at the intersection of these axes.

The direction cosines are determined through a pair of antennas located at the ends of each baseline. The intersection of the baselines will be the origin of coordinates. The direction cosine is obtained from the measured phase difference of the transponder reply carrier signal at the two antennas. High precision is attained by using antenna baselines which are long relative to wavelength. Ambiguities introduced by the long baseline are partially resolved by the use of two additional antennas separated by fewer wavelengths. The short baseline ambiguities are then resolved by cosine data derived from a conventional conical scan direction finder.

Range is determined by comparing the instantaneous phase of a transmitted modulation signal with the received modulation signal. Maximum resolving power is obtained by selecting a high range modulation frequency. Ambiguities introduced by the high frequency are resolved by transmitting two low frequency modulation components.

Velocity of the airborne vehicle is determined from doppler shift measurements. For this purpose the transponder reply carrier is locked in phase with the 98. 3565

KC (Fine Range) modulation signal, which is multiplied 612 times and utilized as a reference within the transponder.

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The accuracy of the direction cosine measurements depends on the accuracy of spacing and orientation of the ground station antennas, and the accuracy to which the received carrier is maintained. The baseline accuracy is insured by precision survey measurements. The received carrier frequency is maintained at 5000 MC by automatic frequency control circuits in the ground equipment and within the transponder. Azusa Mark II performance specifications call for angular rates in azimuth of 1 radian per second, elevation of 14 radians per second and cosine of

The returned signals from the transponder are converted by the receiving system into a form usable for phase comparison in the indicating system. The analog output data of the indicating system is fed into a data handling system where it is converted to digital form for visual presentation and recording on magnetic tape. Data recorded on the tape will include:

- (1) Pre-flight calibration tower data from -60 dbw to -140 dbw in increments of 10 db.
- (2) Pre-flight x-tower and y-tower zero set data.

0. 1 per second. The non-ambiguous range resolution is 1.0 foot.

- (3) Plotting Board Charts.
- (4) Post flight calibration tower data from -60 dbw to -140 dbw in increments of 10 db.
- (5) Post flight x-tower and y-tower zero set data.
- (6) Phase data playback.

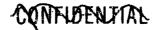
C. Mod III E Trajectory Instrumentation

The missile instrumentation beacons consists of a Rate Beacon, a Pulse Beacon, a common antenna and associated wave guide including low-pass and high-pass filters. These beacons operate in conjunction with related ground equipment to perform instantaneous position and rate measuring functions for impact prediction should the missile follow a ballistic path for the remainder of the flight.

The position tracking subsystem continuously determines missile instantaneous range, elevation, and azimuth heading. The position coordinates are measured by means of a ground based, phas -amplitude, monopulse radar operating in conjunction with the pulse beacon, decoder, and antennas in the missile.

The rate measuring subsystem continuously determines the missile instantaneous rate of change in range, elevation and azimuth heading.

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These are arranged with one central transmitter-receiver antenna and two outlying receiver-antennas. Energy is sent to the missile rate beacon by means of the central transmitter-receiver antenna. The rate beacon replies with a coherent c-w signal radiated back to the three ground antennas. When the missile velocity vector has an angular component with respect to the ground antennas the signal received at one or both of the outlying receiver antennas will be slightly different from that received at the central antenna. The doppler frequency is magnified and sent to the computer subsystem. The computer determines the rates of change in angles by relating this magnified doppler frequency to azimuth and elevation angles.

D. FPS-16 Radar

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The FPS-16 Radar is a high precision C-Band monopulse tracking radar which provides data outputs in the form of selsyn voltages. These voltages represent slant range, azimuth and elevation angles. These radars are used to provide real time, present position and impact prediction data for Range Safety. Currently FPS-16 installations are at PAFB, GBI, and Ascension Island.

The digital outputs are recorded on magnetic tape at 10 samples per second. This data includes azimuth, elevation, range, range rate and a timer code. The standard deviation error of the FPS-16 has been approximated as 75 feet in range and 1 mil in azimuth and elevation angle.

E. Missile Impact Location System

The Missile Impact Location System (MILS) is a system for determining the location of missile impacts through the use of underwater sound techniques. Splash detection and SOFAR bomb detection are the two types in use by AFMTC.

(1) Splash Net

The Splash Net near Ascension Island consists of six moving call hydrophones arranged in a pentagon with a hydrophone near the center. The hydrophones are on the ocean bottom at a depth of approximately 10,000 feet.

The impact of a nose cone on the water surface creates sound energy which emanates in all directions. Some of these rays of energy will reach the hydrophones. Rays which exceed a critical angle will be refracted upward before reaching the bottom. This critical angle will determine the maximum horizontal range over which the hydrophones can detect a splash.

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The impact must be picked up by three or more hydrophones to determine the location of a splash. Any splash occurring within the confines of the net can be determined within 0.1 nautical mile. A splash outside the net but within a 12 mile radius from the net center can be determined within 0.2 nautical mile. Within 12 to 16 mile radius the accuracy is 0.5 nautical mile. At a range greater than 16 miles a direct signal cannot be expected to reach the hydrophones and the location of the splash usually cannot be determined.

2. SOFAR Bomb

This type detection monitors the sound of a SOFAR bomb explosion in the vicinity of the ocean depth of minimum sound velocity by means of hydrophones located near that depth. The Splash Net is capable of monitoring both splashes and bombs, whereas the SOFAR hydrophones can only monitor bombs. Due to the greater accuracies achieved with the Splash Net Hydrophones these are used whenever possible. In these cases the SOFAR hydrophones are a redundant system and are used merely as a check for consistency.

The location of a SOFAR bomb detonation requires that signals be received at a minimum of three receiver sites. The source location of one of a family of time difference curve is established by noting the time difference of the last arrival of the signal between any two receiver stations. Repeating this operation between any different pair of receiver stations will determine the source location.

Within a matter of minutes after impact, travel times of the signals generated at the hydrophones by splash and bomb are transmitted to Western Electric by RCA. These values are transformed to estimates of impact and released to AMR within 30 minutes from time of impact.

F. Optical Tracking

1. Cinetheodolites, CZR-1's and Other Launch Phase Instruments

Metric optical tracking system data, that is, quantitative vehicle position and velocity data derived from optical tracking instruments such as cinetheodolites and the CZR-1 cameras, are necessarily limited to the launch and initial powered flight phases of a test by the comparatively low-range capabilities of these systems. It has been the experience of Convair in the evaluation of many past Atlas missile flight tests that this type of metric optical data, although useful as a source of comparison and backup information, no longer fill a real need and should in general be omitted from the E Series requirements. It is not intended to restrict the documentary, engineering sequential photographic

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coverage or tracking by the ballistic cameras. The coverage of this type deemed necessary is listed in the Program Requirements document.

2. Ballistic Cameras

The missileborne portion of the optical tracking subsystem is provided on specified SM-65E R&D missiles to aid in the calibration of the Azusa, the instrumentation beacons, and the All Inertial Guidance System.

Location of the missile is determined with ballistic cameras located at each of several tracking sites spaced over several hundreds of miles. Each camera is directed toward the sustainer cutoff, vernier engine correction portion of the missile trajectory. During the period between sustainer engine cutoff and nosecone separation, a high intensity strobe light system is triggered at intervals of approximately once each second. A photographic record is made of the light flashes and the star background. Flash occurrences are telemetered to obtain timing data. Comparison of the photographic record; between sites enables the establishment of the x, y and z space coordinates of the missile during the specified time interval.

The missileborne strobe light system is housed in a single [ackage. This package contains a strobe lamp, associated electronics, and a remotely activated "one shot" primary type battery which provides system power. The system is mounted on the forward fairing on the B_1 pod.

G. AMR Tracking Ships

The tracking ships are medified merchant vessels of the Liberty ship class. Each ship carries two radars, in addition to optical equipment for infra-red, visible and ultra-violet observations.

Although the ship is not stabilized, two M-19 gyro compasses will be utilized to stabilize the platforms for the two radars.

The radars have been modified for C-band beacon tracking. They also have provisions for using S-band telemetry for acquisition. They are equipped to measure scintillation spectrum of a target. The radar will be able to pick up the target at approximately 200 miles.

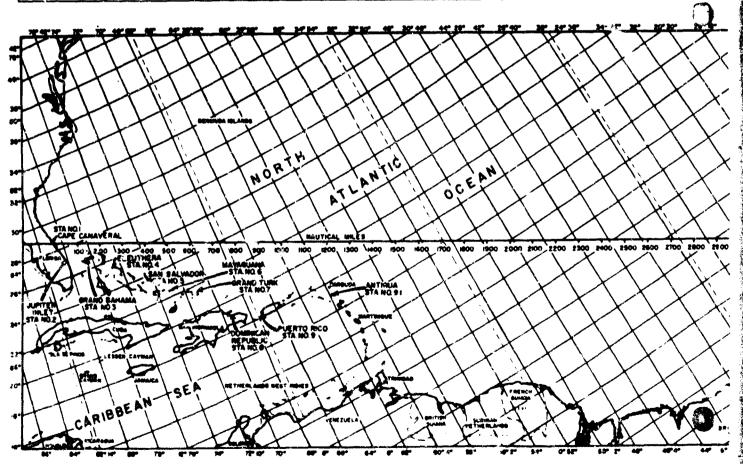
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H. AMR ELECTRONIC TRACKING AND

FACILITY				TLM &	7-TURN	
*STATION	AN/FPS-16 RADAR	60 FT DISH	MOD II RADARS	RECORDING SYSTEMS	HELIX ANTENNA	TRI-HELIX ANTENNA
1	Х	х	х	X	х	Х
2				X	Х	
3	X			х	X	X
4			X	X	X	
5	x		X	x	х	j
6				x		
7			X	X	Х	
8					ļ	
9	X	X	X	x	X	X
9A		}		X	X	}
11				Х		1
12	x	х	X	X	X	X



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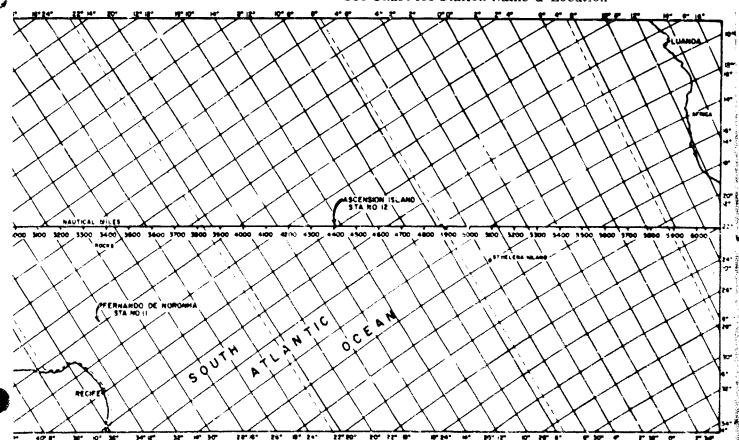
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TELEMETRY EQUIPMENT INSTALLATIONS

COTAR	AZUSA	AN/F PS-8 RADAR	COMMENTS
X	X	Х	Complete tracking, telemetry, data reduction facilities Limited to receiving telemetry
		X	
			Inactive
			Inactive
X			Splash net (MILS) impact location

* See Chart for Station Name & Location



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III. SUPPORT DATA

A. General

Support data is defined as that data which cannot be classified as internal or tracking but is of the nature which supplements internal and/or tracking data. Included in this category are: All data gathered to determine the performance of the ground support equipment and site facility system, weather, time, still photographs, movies, launch coordinates, voice, chemical analysis of fuels, computer outputs, etc. A large amount of support data is gathered via the landline instrumentation system which is described in section 4-1 of this report.

B. Engineering Sequential Photos

1. Camera Coverage

Photographic coverage at AMR is the responsibility of RCA. Minimum requirements for adequate engineering coverage on each Atlas flight are considered to be as follows:

- a. Four stationary cameras located 90 degrees apart around the missile. The film should be exposed for skin after engine firing and liftoff. Minimum frame rate should be 96 FPS, with an image to frame ratio of 1:1. The purpose of these cameras is to provide engineering data concerning the launcher at liftoff, separation of the umbilicals, and general launch configuration.
- b. One stationary camera located on the ramp. The exposure on this should also be for skins after liftoff, with a minimum frame rate of 96 FPS. The frame should include both launcher heads and the booster section to just above the vernier engines. This camera provides valuable data on launcher operation and missile motion at liftoff.
- c. Three stationary cameras located 120 degrees apart around the missile. Exposure should be for skin after liftoff and frame rate either 32 or 64 FPS. Image to frame ratio should be 1:2. These cameras furnish data concerning missile motion, and ver fy the operation of missile systems.
- d. A minimum of three tracking cameras with long focal lengths, located in the area so as to provide flight coverage from either side and aft of the

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B)

missile throughout booster phase. For daylight flights, the film should be exposed for skin. For night flights, exposure should be for flame. Frame rate should be 32 FPS, with an image to frame ratio of about 1:2 prior to liftoff. These cameras provide information regarding operation of the missile during the booster phase of the flight.

e. In addition to the above coverage, items such as ROTI (Recording Optical Tracking Instrument) and IGOR (Intercept Ground Optical Recorder) are desirable for a complete evaluation of a missile flight.

2. Cameras

a. Mitchell High Speed Camera

The Mitchell motion picture camera (16mm and 35mm) is the standard camera used at AMR for medium and high speed photography. Normally, a four lens turret is used, containing lenses of 25mm to 152mm focal length. Other lenses of longer focal length up to 20 inches are also available for turret mounting, and 40 inch and 80 inch lenses can be used with special mounts.

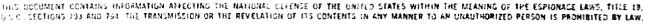
Range timing is introduced on the outer edge of the film.

b. Fastax Camera

Fastax cameras (16mm and 35mm) are prism type high speed cameras for motion and flame studies. Although capable of higher rates, the maximum frame rate used at AMR is 1000 FPS. Range timing codes are exposed by neon lamps on the outer edge of the film. Interchangeable lenses from 1 inch to 40 inch focal length are available.

c. Milliken Camera

The Milliken camera is a compact 16mm motion picture camera used for studies inside the launcher. A special protective housing is used to protect the camera from environmental effects in this area. A standard 40 frames per foot, 200 foot internal spool load is used. The camera is capable of frame rates of from 16 to 400 FPS. Normally, a 10mm lens is used.



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d. Hulcher 70MM Camera

Hulcher 70mm cameras are used for engineering sequential coverage in the pad area. With this coverage, larger size images and greater detail is possible than with smaller film sizes. The cameras use a 7 inch, 12 inch or 20 inch lens, and operate at 10 FPS. The camera running time is approximately 22 seconds.

e. Flight Research Camera

70mm flight research cameras are also used to provide engineering sequential coverage in the pad area. These are intermittent pin registered motion picture cameras. They may be operated at 10, 15, 30, 45 or 60 FPS, in conjunction with a 40, 60, 80 or 120 inch focal length lens. An external 400 or 100 foot magazine load is used, with a $2-1/4 \times 2-1/4$ film format.

f. Photosonics

The Photosonics full frame 70mm camera is an intermittent pin registered motion picture camera. It uses a variable opening rotary disc shutter with 2° to 120° opening. Operations may be carried out at 10, 20, 30, 40, or 60 FPS. An external 1000 feet magazine load is used with a 2-1/4 x 2-1/4 film format.

C. Closed Circuit Television

This system is used as a supplement to the Launch Control System and the Landline Instrumentation System in monitoring and controlling missile actions.

The basic closed circuit television configuration and capabilities will be supplied by combined contribution of the following major equipment items or their equivalent. The system described below will apply to all complexes.

1. Cameras and Accessories

- a. Four remote cameras RCA #M1-36067
- b. Three weatherproof housings RCA #M1-36075 and one explosion and dustproof housing RCA #M1-36074B

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- c. Three outdoor pan and tilt units RCA #M1-36098 and one explosionproof pan tilt unit RCA #M1-36098E
- d. Three zoom lens (60-300mm focal length) and one (30-150mm focal length). Perkin Elmer or equal.

2. Monitors and Controls

- a. Four 17" TM 7C monitors RCA #M1-26141
- b. Four 17" TM 7C slave monitors RCA #M1-26141
- c. Four 1TV 6A control monitors RCA #M1-36068A
- d. One 19" wide by 21" high remote control panel

3. Required Specification Features:

a. Electrical Characteristics:

Vertical sweep frequency..... 60 cps
Frame frequency...... 30 cps
Lines horizontal resolution.... greater than 500 lines

Camera and monitor bandwidth 8 mc

b. Mechanical Characteristics:

c. Environmental Capabilities of Camera:

Vibration and shock ruggedized type
Ambient noise level mounted to attenuate over 175 db

Temperature..... min 30° to $\pm 50^{\circ}$ C

Sensitivity minimum light level. . . . 1.5 candles



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See the illustrations section of this report for configuration of cameras, monitors and controls.

D. Visual Panel Meter Presentations

A list of visual meters has been compiled and is presented in the composite and landline tabulations in order to provide a more complete picture of the important monitoring devices which will be available to test personnel in their maintenance of blockhouse test control. In order to differentiate these functions from the "1000" series direct line measurements, a "M000" series designation will apply to these visual panel meter presentations.

E. Timing Code

At AMR a 12 bit, 100 PPS, 1000 cycle are litude modulated carrier timing code with a recycling time of 15 minutes is used. The time word is contained in the 12 bits, 4 bits for each of three digits contained in the time word, and the 100 PPS are amplitude modulated on a 1000 cps carrier. The AM modulation is 3.3 to 1 with the pulses at a 10 volt level and the no pulses at a 3 volt level. The three digits represent units, tens, and hundreds of seconds by using a binary-coded decimal (8-4-2-1). A reference pulse always appears first and indicates the beginning of the time word. The leading edge of this pulse is the point on the chart at which the time occurred. No other part of the time word is time coherent. To read the code one must recognize be difference in pulse widths of three types of pulses: the reference calse is five units wide, a binary "1" is three units wide, and a binary "0" pulse is one unit wide. The zero time reference for missile launchings is one inch motion in contrast to "D" series which uses two inch motion as its initial time. See the illustrations section for a sample of the timing code with a graphic explanation.

F. Weather Data

All weather data is collected and evaluated by the AMR staff weather officer. A complete surface observation is made at T-time. Upper air soundings are made at the Cape and at various down range stations. The following data has been requested for E series flight tests.

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Data Required	Range Required	Accuracy Required	_
Pressure	Surface	2 MB	
	0 to 200, 000'	± 2% to 60, 000'	
		± 5% above 60, 000'	
Temperature	Surface	± 2° C	
	0 to 200, 00°	± 2° C	
Humidity	At launch point	± 5 %	
Wind Speed	0 to 200,000'	10 FPS	
Wind Direction	Surface	± 10°	_(B)
	0 to 25,000'	± 5°	
	25K to 45K	± 5°	
	45K to 200K	± 5°	
Cloud Cover	Vicinity of each range station	0. 1%	
Visibility	Vicinity of each range station	0.5 NM Less than 10 NM, 1 NM greater than 10 NM	
Precipitation	At launch	0. 05 IN	

Ionospheric Sounding

Electronic density (electrons per cubic centimeter) at vernier burnout altitude is required to make preflight corrections to the Mod III Instrumentation System computer. Tabulations of electron density versus altitude have been requested to be derived from samplings made at GBI and San Salvador.

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DATA HANDLING, PROCESSING AND REPORTING REQUIREMENTS

I. DATA HANDLING

Atlas Flight Test Data gathered by the range will be handled according to the nature of the data. In general, the normal data handling procedure is as follows:

A. Telemetry Records

AFMTC recorded tapes will be made available to the Flight Test Working Group (FTWG) within one hour after the flight for quick-look analysis. The telemetry tapes recorded at the downrange stations will be identified (station number, date, test number) and flown to the Cape. Here they will be copied and distributed as required.

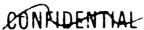
Telemetry tapes from Station Nos. 1 (Cape) and 3 (Grand Bahama Island), will be flown to San Diego for processing within 24 hours after the flight. Tapes from the remaining stations are not normally required by Convair for post-test analysis.

B. External Data

Data which is gathered by means external to the missile, i.e., other than the RF telemetry link, is referred to as external data. This is conveniently separable into the categories of landline data, metric data, documentary data, and miscellaneous data.

- 1. Landline Data These are gathered via graphic, Esterline-Angus and oscillograph recorders. The original recordings will be flown to San Diego within 24 hours to aid in the test analysis.
- 2. Metric Data All metric tracking data (including that obtained from film, electronic and optical tracking devices) will be reduced and distributed by the range. Tabulated data, IFM eards or tapes will be distributed as required. (See range data tabulation.)
- 3. Documentary Data Sequential and motion picture film will be processed by the Base. Normally, copies will be received at San Diego within 96 hours. Logs of system operation are kept during countdown operation and missile flights, for certain of the missile systems. These will be copied and sent to San Diego for historical purposes.

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4. <u>Miscellaneous Data</u> - Included in this category are various recordings made to obtain additional information on the electronic missile systems, range safety information, special studies and weather data. Normally, this data will be returned to San Diego for processing and analysis.

II. DATA PROCESSING

Processing of the original telemetry tapes, recorded by the range, from Station Nos. 1 and 3 is normally considered sufficient for data analysis.

The recorded telemetry data will be gathered on a 1/2 inch, 7 track tape recorded at 60 inches per second. A typical tape format is as follows:

Track 1: RV RF #1

Track 2: CV-A RF #2

Track 3: CV-A RF #3

Track 4: Voice Annotation (modulates a 70 KC subcarrier and identifies tape),

17 KC (± .1%) speedlock, range timing (13 bit, 1 PPS, 12 bit, 100 PPS),

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100 KC and 50 KC compensation signals, signal strength of each link

frequency

Track 5: 100 KC and 50 KC compensation signals

Track 6: CV-A RF #1

Track 7: RV RF #2

The telemetry tapes will be processed by the ICS San Diego and Florida data processing stations. Here the data will be played back in a form suitable for analysis.

III. TEST REPORTING

A. Countdown TWX'S

TWX's will be sent for each test during which engine ignition is planned or for any special test so designated by the Chief of Field Test Engineering. The TWX's will be sent as follows:

 At the initiation of the countdown with a description of the test, planned countdown time, name of test conductor and weather outlook at launch and impact sites for flig it tests. Each TWX for any one operation shall be serially numbered.

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- 2) Once every 60 minutes if the count is proceeding satisfactorily.
- 3) At the initiation of each hold, with the reason for the hold and an estimate of hold time.
- 4) At the initiation of the count following each hold.
- 5) Continuous transmission during the last 15 minutes of the count.

B. X + 1 Hour TWX

An X + 1 hour report is required for each test conducted at any site in which ignition is planned or for any special test so designated by the Chief of Field Test Engineering. This requirement also applies to aborted tests and incidents or accidents.

In the event that the countdown was aborted prior to engine ignition and all details of the abort are included in the X+1 report, then this report will close out the TWX cycle for the test.

The following information will be reported in the X + 1 hour TWX:

- 1. type of test
- 2. complex identification
- 3. missile number
- 4. test number (s)
- 5. date and time of test
- 6. test durations, both planned and actual, actual can be approximated
- 7. type of cutoff
- 8. visual hardware comments
- 9. preliminary comments on any difficulty, either from panel operators or from real time records, if available
- 10. preliminary impact point and source of data (for flights)

C. X + 5 Hour TWX

This TWX is an extension of the X + 1 hour report. It is to contain any additional hardware comments and any significant analysis comments based on available data. No attempt shall be made to draw any conclusions from the data in the event of any system malfunction. If the data indicates any anomalies, then the abnormal variation of the data shall be described.

D. X + 24 Hour Preliminary Report

This report is required for any test in which engine ignition is planned or for any special test so designated by the Chief of Field Test Engineering.

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The following information will be reported in the stated order.

- 1. A paragraph or two summarizing the test.
- 2. A writeup on the operation or performance of each system. The order of systems is arbitrary, however, systems with difficulties should be presented first.
- 3. A writeup on the countdown including the time of start of the count, planned countdown time, actual countdown time, and a description of each hold, including hold time and recycle time if any.

E. FRF or Flight Test Working Group Report

This report is the requirement of the Flight Test Working Group for a flight or Convair management for an FRF conducted at AMR on the Atlas program. The report is required within 14 days after a test. This report will include but not be limited to:

- 1. Summar/
- 2. Test Objective Status
- 3. Trajectory Data (if a flight)
- 4. Analysis of all Systems' Performance
- 5. Film Review Comments
- 6. Conclusions and Recommendations
- 7. Countdown History
- 8. Missile Configuration
- 9. Missile History
- 10. Appendix including.
 - a. Reference Documents
 - b. Serial Numbers of System Components
 - c. Significant Dates of Series A, B, C and D Testing
 - d. Test Constants
 - e. Redline Values Vorsus Recorded Data

F. Test Evaluation Report

This is the final flight test evaluation report as required by contracts, Air Force directives and Convair management. This report is required 14 days after the flight date.

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The following information is included.

- 1. Summary
- 2. Test Objective Status
- 3. Trajectory Data
- 4. Systems' Performance Analysis
- 5. Flight Test Configuration
- 6. Configuration Comparison with Previous Test Articles
- 7. System Components and Serial Numbers
- 8. Summary of Preflight Tests
- 9. Test History
- 10. Difficulties Report
- 11. Countdown Time versus Events

G. Summary Reports

This report summarizes a group of tests and is required by contractural agreements and/or by Convair management. For flight testing, three summary reports were issued upon completion of the Series A, Series B and Series C programs respectively. The number of Series D flights dictates that two summary reports will be issued for the D program for more current effectiveness. In general, summary reports are due eight weeks after completion of the last test in the series.

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REPORT	PREPARED BY Site	SIGNED BY Base Manager or Chief Test Conductor	W. W. Withee, P. J. Lynch, A. D. Mardel, H. R. MacDonala, C. A. Walruff, J. R. Dempsey, W. L. Young, M. Hosenbaum, W. H. Patterson, C. S. Ames, W. L. Van Horn, J. L. Bowers, H. F. Dun- holter, C. T. Newton, J. S. Harrison/K. E. Newton, H. O.
+ 1 Hour TWX	Site Data Group	Chief Test Conductor	Welty, R. J. Blake, J. T. Porter- field/J. H. Kelley Same as above.
5 Hour TWX	Site Data Group	Chief Test Conductor	Same as above.
X - 24 Hour Report (Preliminary Test Results)	For AMR FRF Site Data Gro	Chief Test Conductor	Convair Management, CVA Field Offices in Wash., D. C. etc., Project Office. Design Gros.
	For AMR Flight Test Evaluation	Test Evaluation	Support Grps., Test & Support Grps. at all sites, Associate Contractors, CVA AFBMD Rep-
			resentative. Master distribution lists for approx. 165 copies are on file in Test Evaluation.
FRF or FTWG Report	Site Data Grp	Flight Test Working Grp. or Chief Test Conductor for an FRF	Flight Test Working Group, Test Evaluation, and all test site libraries.
Test Evaluation Report	Test Evaluation	Assistant Chief Engineer - Test, and Chief Engineer	Same as X + 24 Hour Report, plus contract requirements.
Summary Report	Test Evaluation	Assistant Chief Engineer - Test, and Chief Engineer	Same as Test Evaluation Report

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OPERATING INSTRUMENTATION CONSIDERATIONS

E series operating instrumentation required for flight articles, at present, is under review. The tabulation of operating instrumentation included in this report and the following discussion should be considered in this light.

Operating considerations as discussed in the following paragraphs are limited to those measurements visually monitored to verify proper performance of missile systems. It should be noted that most missile parameters required to insure proper missile conditions are presented on panel lights and meters and as such are not covered in this discussion. However, a list of panel meters for operating measurements can be found in the panel meter missile instrumentation composite and the individual missile landline tabulations.

In general, operating measurements may be divided into two categories for flight missiles:

- 1. Those necessary for validating or checking out a system prior to missile countdown, and
- 2. Pre-start operating measurements to which prescribed limits are set and which require corrective action or discontinuance of the countdown if prescribed limits are exceeded.

Operating limits and missile effectivity are indicated in the operating instrumentation tabulation.

F 1001 P	LO ₂ TANK HELIUM	Valid	Pre- Start Redline
F 1003 P	FUEL TANK HELIUM		x
maintain missile	nust be maintained within specified limits to structural integrity. Str., chart recordings as furnish a real time record upon which corn be based.		
F 1246 P	BOOSTER TANK HELIUM BOTTLE HI		x
F 1145 P	S CTL HELIUM BTL		x



These measurements assure that the airborne helium bottles are properly pressurized prior to missile firing. In case of a missile abort, bottle pressure data can be monitored to

verify that the bottles are in a safe condition.

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			Valid	Pre- Start Redline
	N 1310 P	SLUG CH LO ₂ DISCH	x	x
	N 1314 T	SLUG CH LO ₂ DISCH	x	X
at th	ne proper tem	e slug chill unit transfers sufficient LO ₂ perature, and to insure no excessive in the slug chill unit, the above measure-cred.		
	N 1335 X	SLG CH LO2 DISCH VLV	x	
	N 1336 X	SLG CH LO ₂ VENT VLV	x	
	N 1337 X	SLG CH LO2 INLET VLV	x	
	N 1338 X	SLG CH LN2 INLET VLV	X	
	N 1339 X	SLG CH GN2 INLET VLV	X	
each	slug chill tra	rements are made during validation of unsfer unit to insure that valves have by and in the correct sequence.	and the second second	
	P 1474 P	VERN CTL REG DISCH	x	x
		is measurement is to verify proper prior to missile firing.		
	S1122V	SERVO TEST SIGNAL	x	
	S1107V	B1 PCH ACTR FEEDBACK	x	
	S1108V	B2 PCH ACTR FEEDBACK	x	
	S1113V	V1 YAW ACTR FEEDBACK	x	
	S1114V	V2 YAW ACTR FEEDBACK	x	

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		Pre- Start Valid Redline
S1118V	V2 PCH ACTR FEEDBACK	x
S1119V	V1 PCH ACTR FEEDBACK	x
S1128V	B1 YAW ACTR FEEDBACK	x
S1129V	B2 YAW ACTR FEEDBACK	x
S1216V	S PCH ACTR FEEDBACK	x
S1217V	S YAW ACTR FEEDBACK	x

The servo test signal furnishes data on the input to the servo amplifier loop of the autopilot. The actuator feedback voltages when compared to the input signal provides information on engine threshold, frequency response, system continuity, gain and polarity.

S1121V	GYRO TEST SIGNAL		X
S1147V	PITCH GYRO AMP OUT	je s	X
£1148V	YAW GYRO AMP OUT		x
S1149V	ROLL GYRO AMP OUT		х

The gyre amplifier output signals when compared with the gyro test signal provides a check on proper displacement gyro operation. These outputs will also indicate the rate gyros are operable when a form of the "kick test" is performed. In addition, this instrumentation indicates frequency response system continuity, bain and polarity.

S1048V	PROGRAMMER PITCH SIGNAL	x
S1049V	PROGRAMMER ROLL SIGNAL	x
S1235X	PROGRAMMER RUN TIME	х

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Confirmation of programmer operation and sequencing is accomplished by running the programmer at 10 times normal speed and monitoring the outputs for voltage level and time of occurrence. The above instrumentation provides part of this information.

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Note: Additional autopilot parameters which could affect testing are monitored but not recorded. Meters are used to indicate power supply current and voltage.

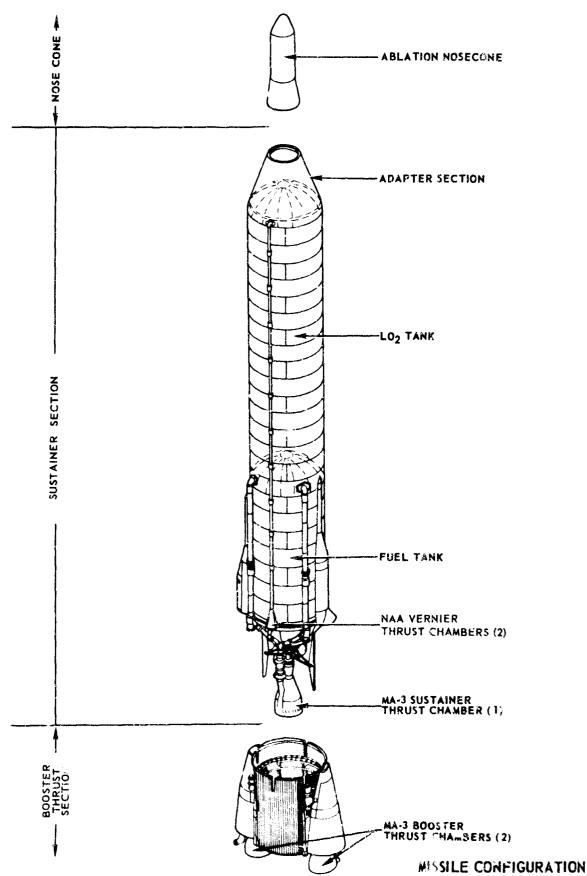
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SECTION 7

ILLUSTRATIONS

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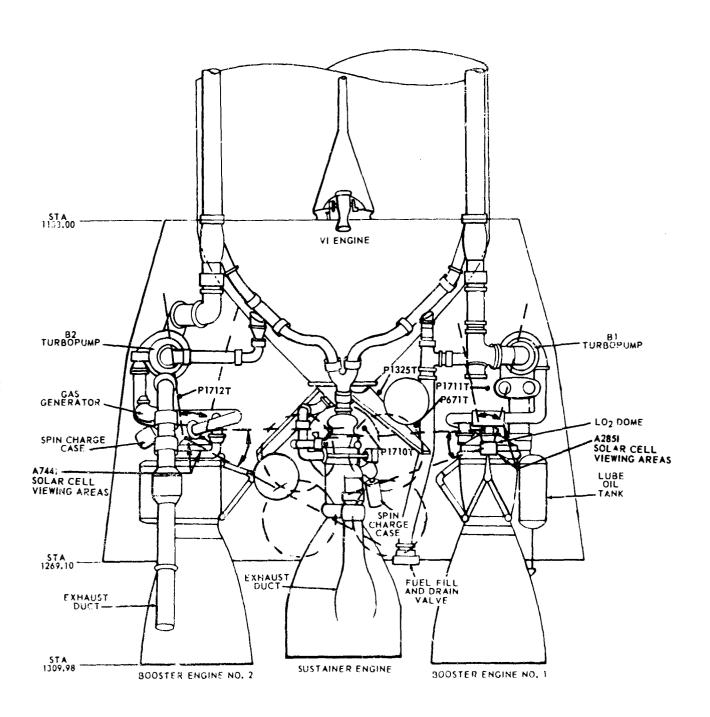
YAW PITCH ROLL Y AXIS QUAD I **QUAD IV** TURBINE EXHAUST DUCT LOS FILL & DRAIN DUCT-DECOY FAIRING FUEL FILL & DRAIN DUCT HELIUM BOTTLES X AXIS -VI ENGINE -- V2 ENGINE HELIUM BOTTLES DECOY FAIRING PEDESTAL LONGERON TURBINE EXHAUST DUCT QUAD II **QUAD III** Y AXIS

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MA-3 ENGINE COMPARTMENT INSTRUMENTATION

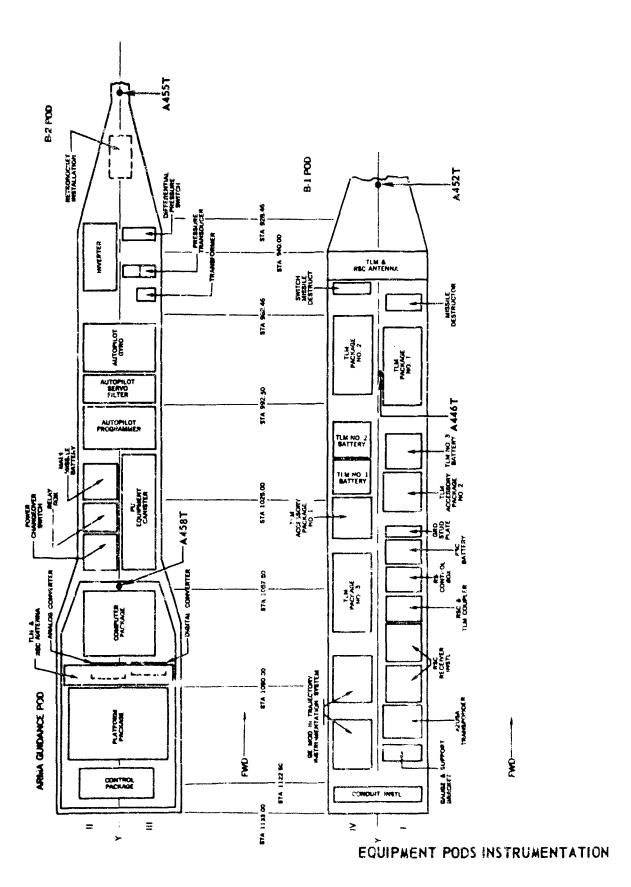
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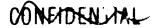
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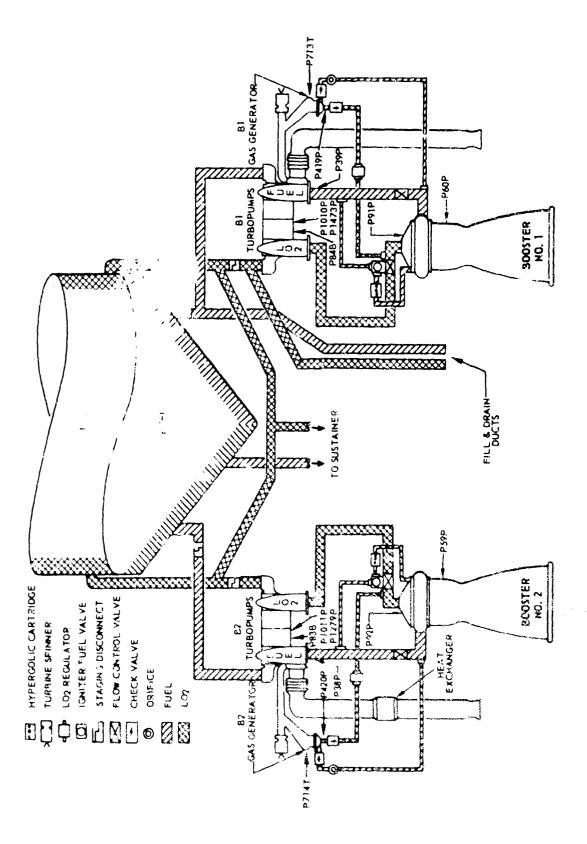


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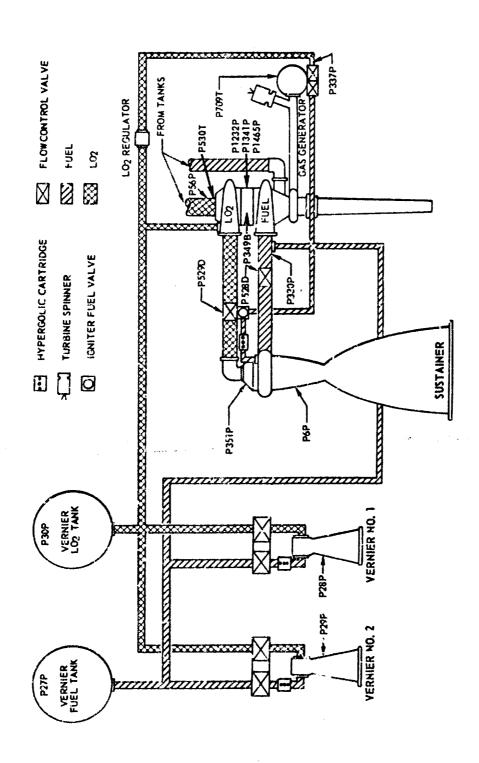


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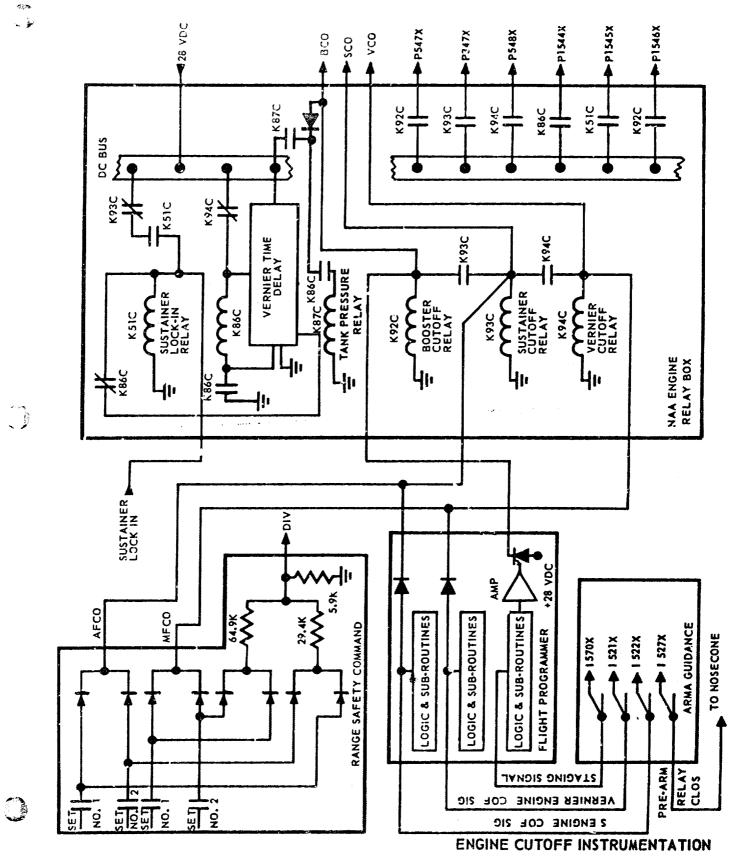
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SUSTAINER AND VERNIER ENGINES

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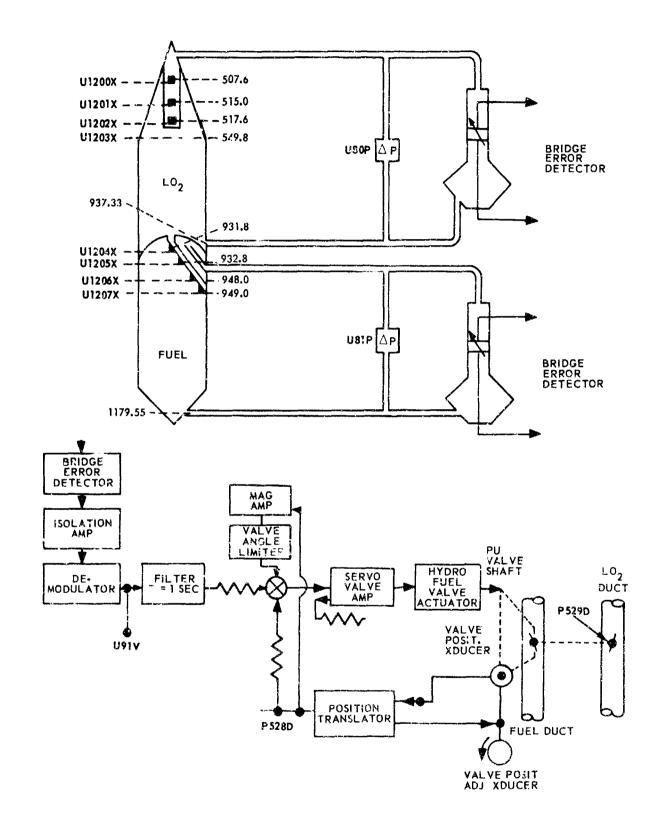
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CONVAIR PROPELLANT LOADING/UTILIZATION SYSTEM

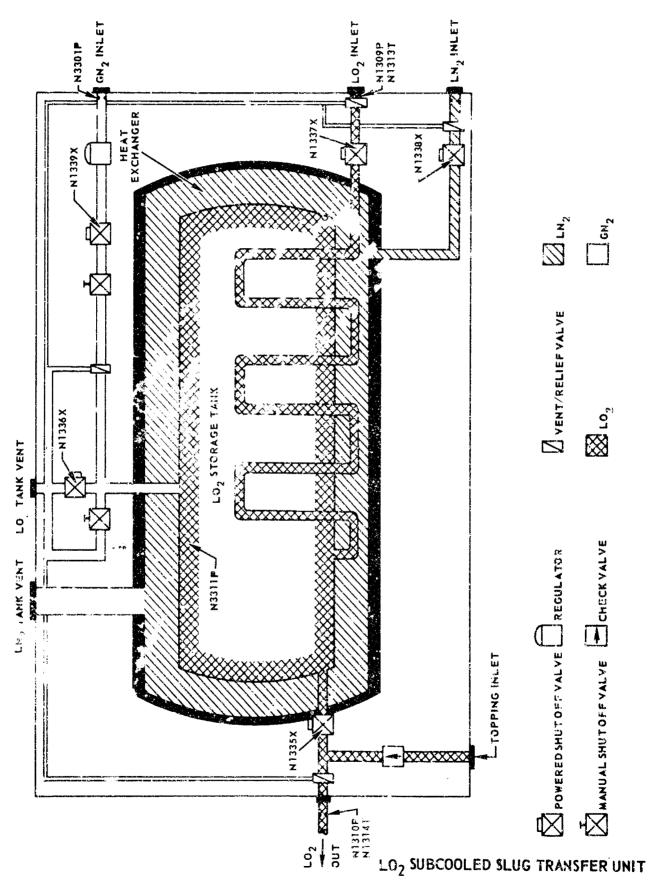
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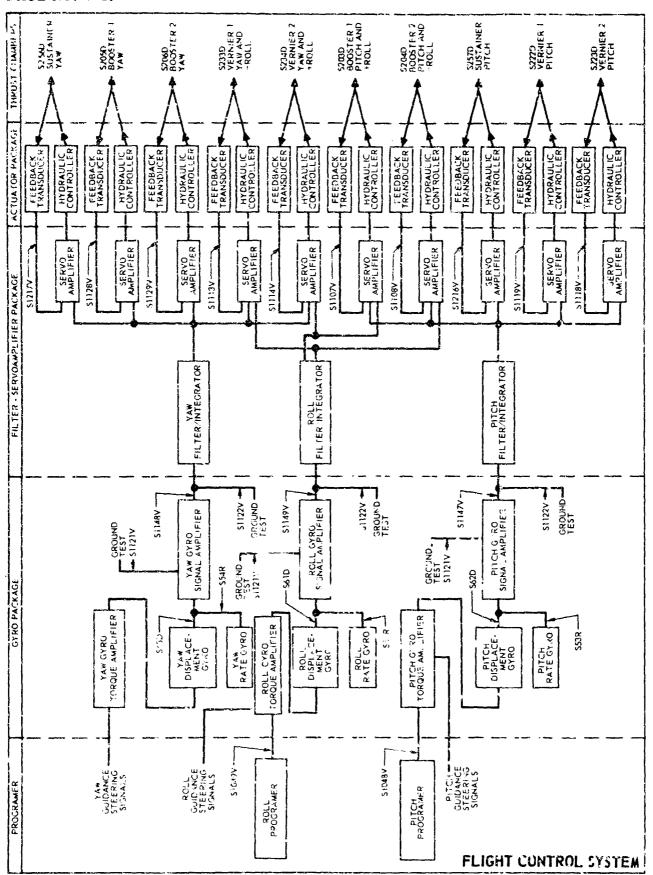


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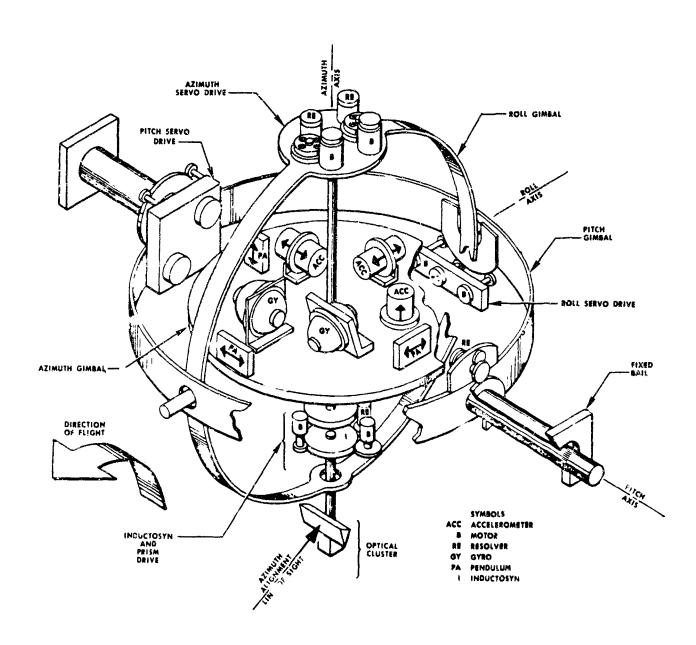
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ALL INERTIAL GUIDANCE PLATFORM

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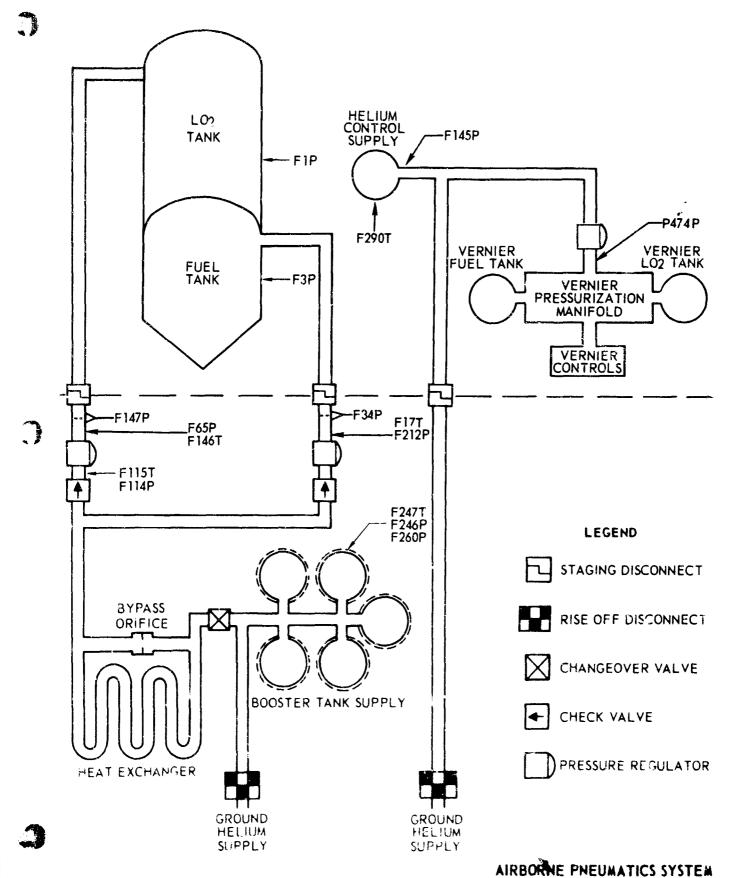
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O 1525X 1526X 1527X RE-ARM YAW STEERING 1528V PINE POLL CONTROL PITCH STEERING **≅**⊙ COMPARATOR AND MEMORY CONVERTER AND COUPLING NETWORK ISOUL 1545V 1543V (2) 1547V 1544V (1546V **⊘**1530V **€** 1580V **∂**§§ CONTROL UNIT COMPUTATION 1508H 1508H 1508H YAW TESOLVER ROLL FITCH ESOLVER 1519A 1520A 15134 O 1516A_0 (2) IS31T 2) IS32T Z AXIS ACCELEROMETER Y AKIS ACCEL EROMETER SGNRO PICK OFF X AXIS ACCEL EROMETER SIGNAL PICA OFF GYRO SIGNAL PICK OFF COORDINATE RESOLVER WINDIN **ROL**L 210 POLL VIA DE JITAL SIGNAL CONVERTER VIA ANALUG SIGNAL CONVERTER **©** 5500 ALL INERTIAL **GUIDANCE SYSTEM**

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PAGE NO. 7-13



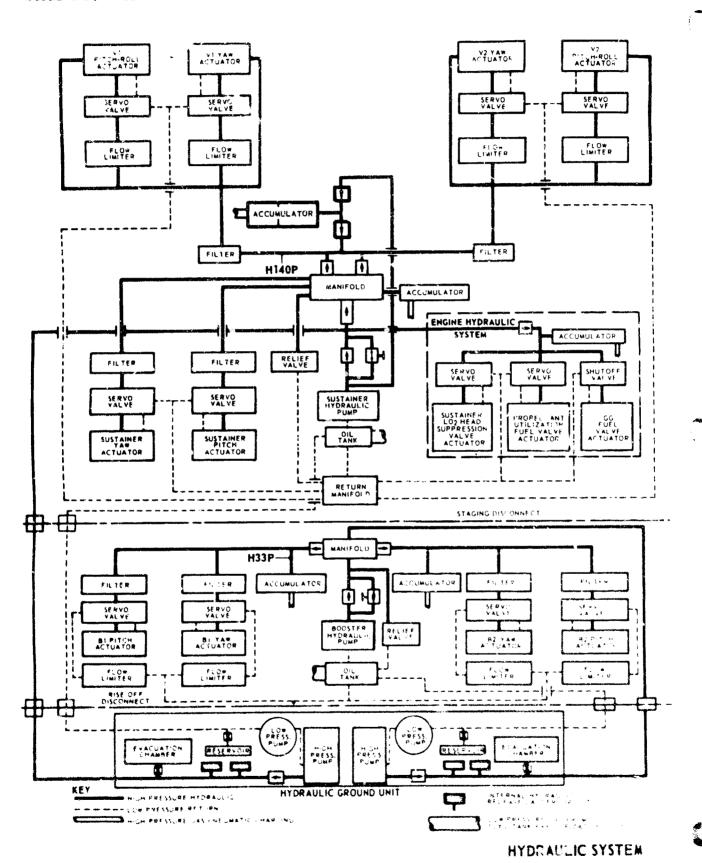
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REPORT NO. AZC-27-059

ADMINISTRATION OF THE PROPERTY
PAGE NO. 7-14

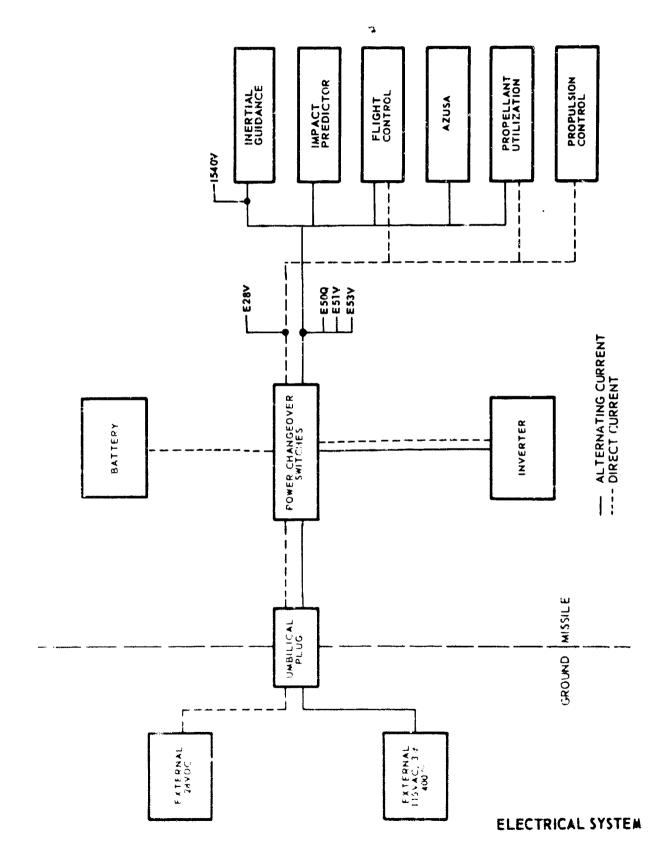


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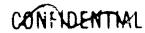
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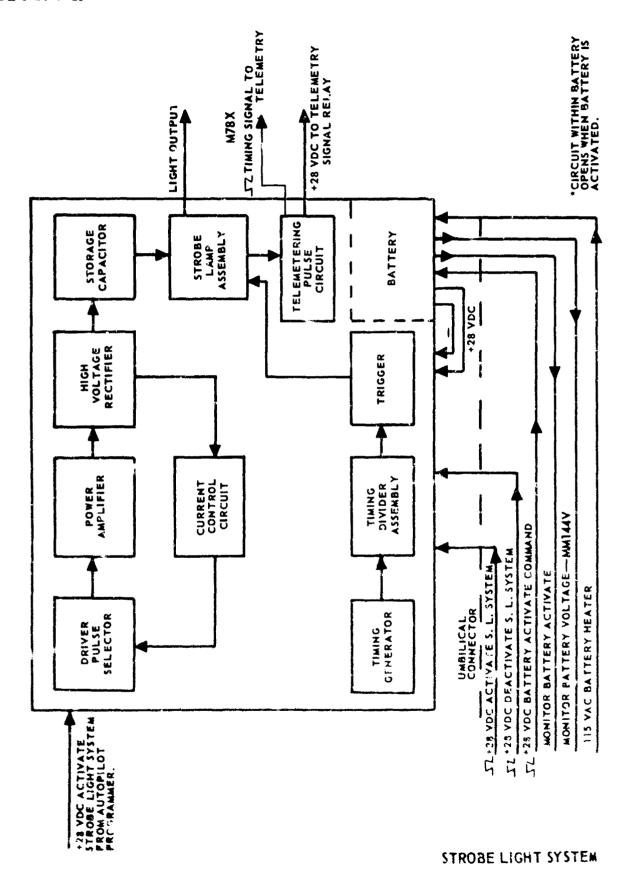


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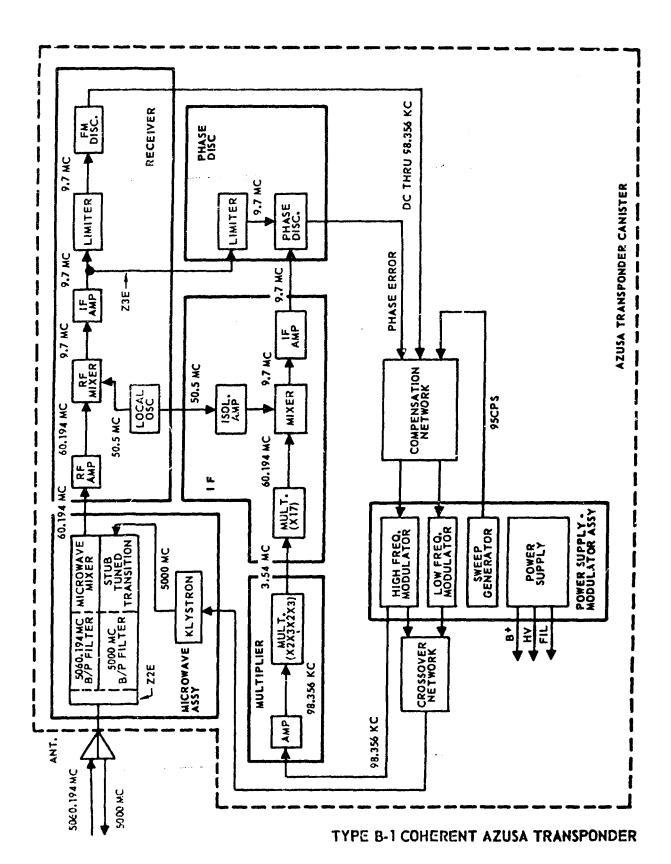
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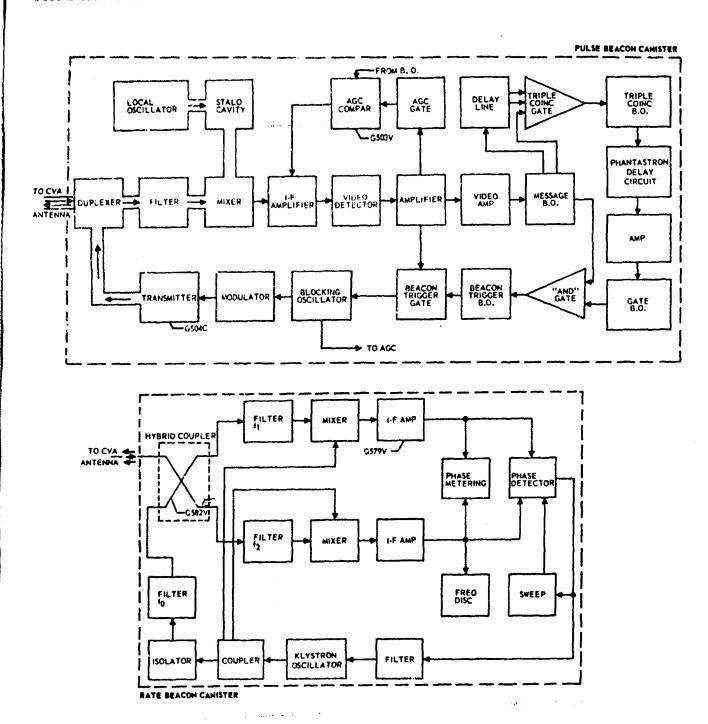


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REPORT NO. AZC-27-C59

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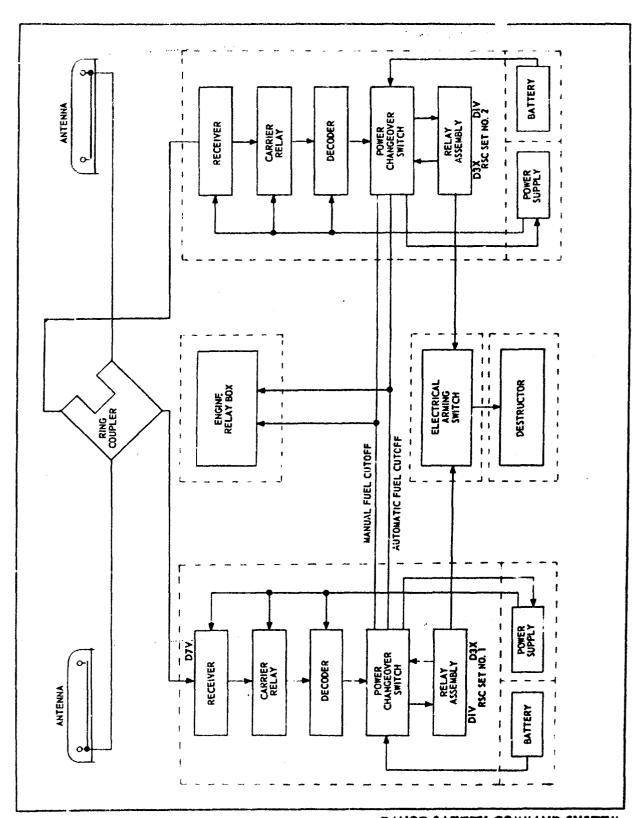


MOD III TRAJECTORY INSTRUMENTATION SYSTEM

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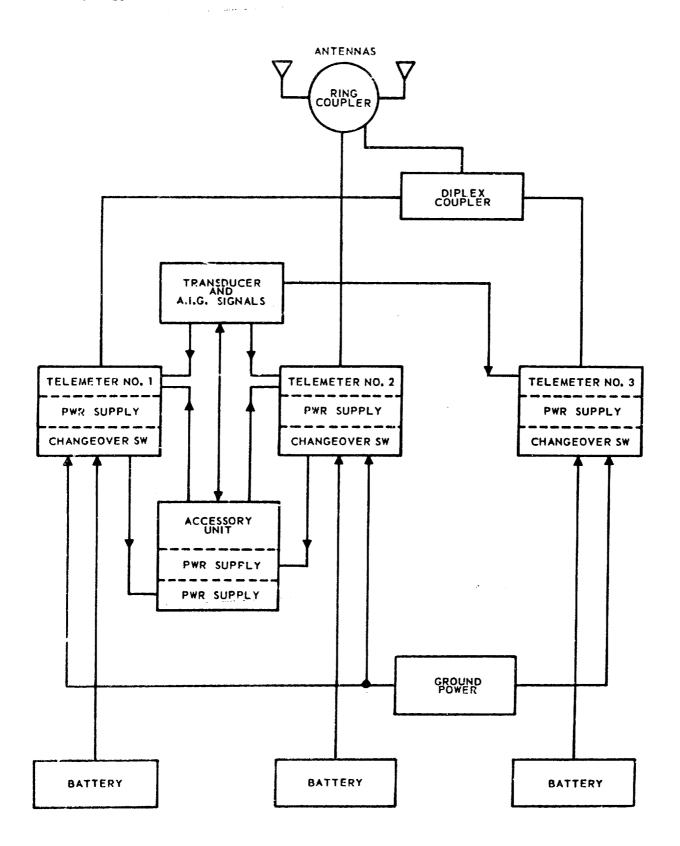
RANGE SAFETY COMMAND SYSTEM

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PAGE NO. 7-20



TELEMETRY SYSTEM - E/R & D

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REPORT NO. AZC-27-059

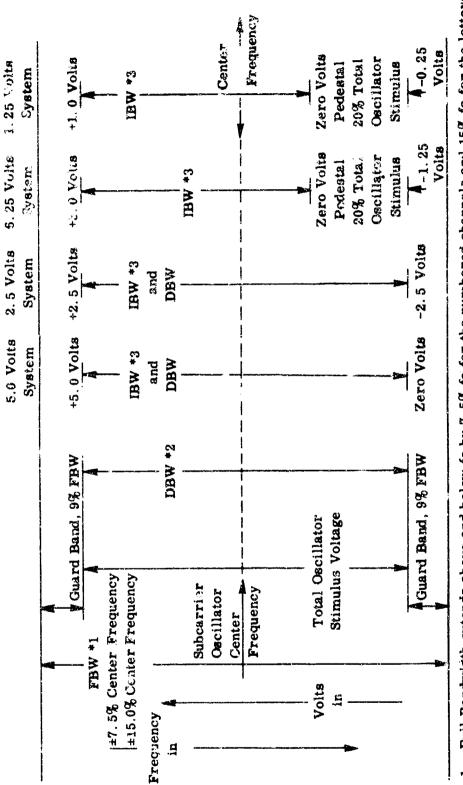
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Full Bandwidth extends above and below to by 7.5% to for the numbered channels and 15% to for the lettered channels.

Design Bandwidth equals 82% FBW.

Inscrimation Bandwidth equals any continuous 80% DBW when a pedestal voltage is used. If a pedestal voltage is not used, IBW equals DBW. .. ن

BANDWIDTH TERMINOLOGY

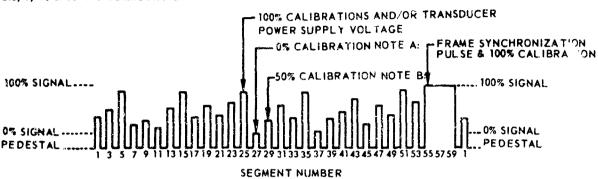
THIS DOCUMENT CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN HE MEANING OF THE ESPIONAGE LAWS, TITLE 18, U.S.C. SECTIONS 793 AND 794. THE TRANSMISSION OR THE REVELATION OF ITS CONTENTS IN ANY MANNER TO ALL UNAUTHORIZED FERSON IS PROHIBITED BY LAW.

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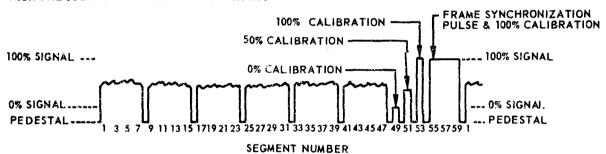
PAGE NO. 7-22

2.5, 5, 10 & 30 RPS COMMUTATION RATES



EFFECTIVITY: TLM NO. 1 CHANNELS 11, 12, 13 & A TLM NO. 2 CHANNEL 11E

COMMUTATION WAVEFORM
1/8 RPS COMMUTATION RATE
HIGH FREQUENCY VIBRATION MEASUREMENTS



EFFECTIVITY: TLM #1 CHANNEL C

NOTE A: 1. FOR VOLTAGE AND PRESSURE MEASUREMENTS
0% CALIBRATION IS MISSILE GROUND
2. FOR TEMPERATURE MEASUREMENTS
0% CALIBRATION IS 500 OHMS ABOVE
MISSILE GROUND.

NOTE B: ON TEM NO. 1 CHANNEL 11 AND TEM NO. 3
CHANNEL 11 PIN 29 IS VOLTAGE 0% CALIBRATION.

NOTE C: TELEMETER 1, CHANNEL E IS A DIGITAL CHANNEL.

COMMUTATED WAVE FORMS - E/R&D

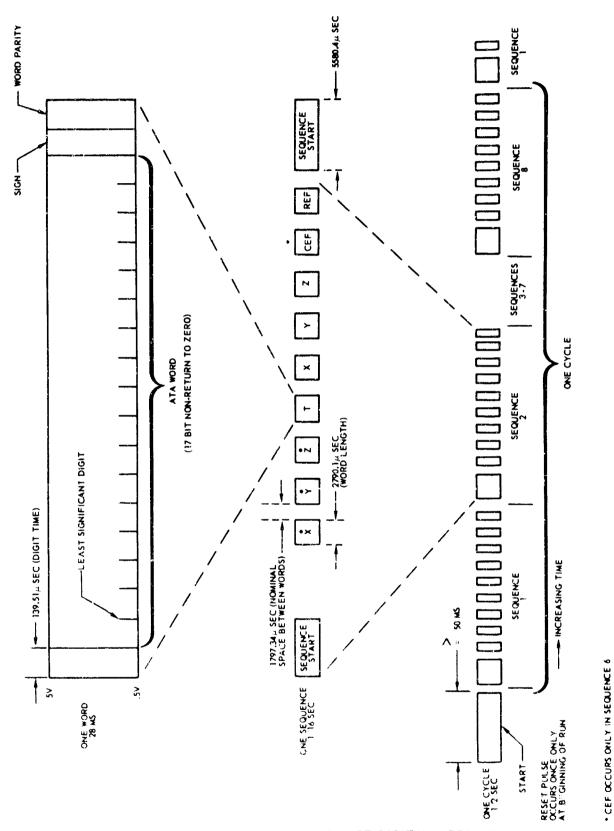
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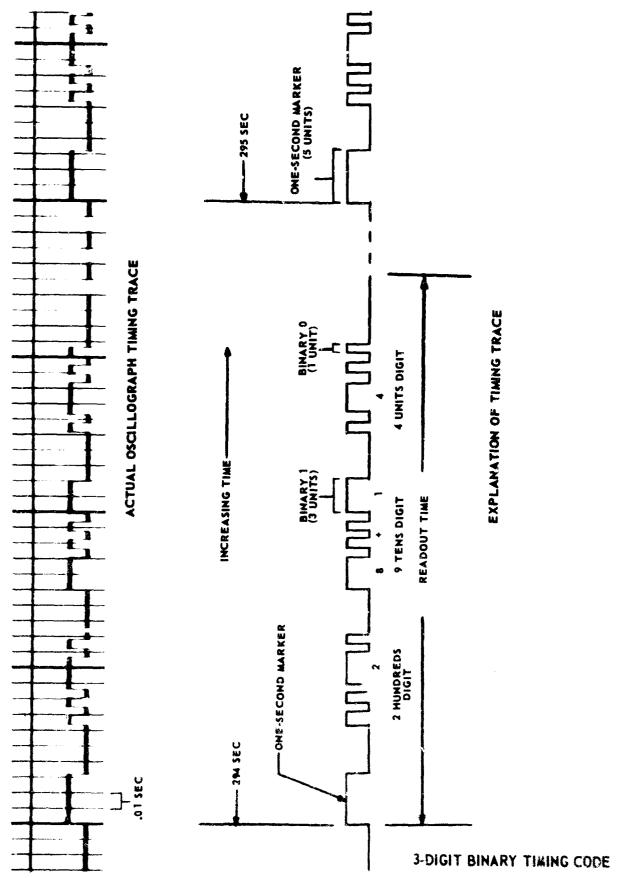
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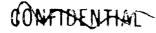
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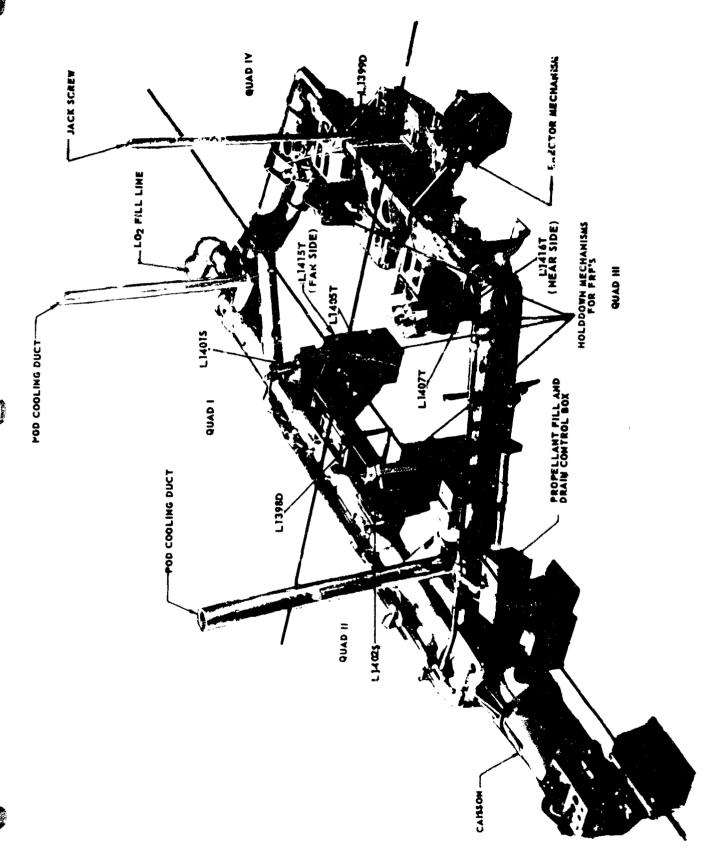
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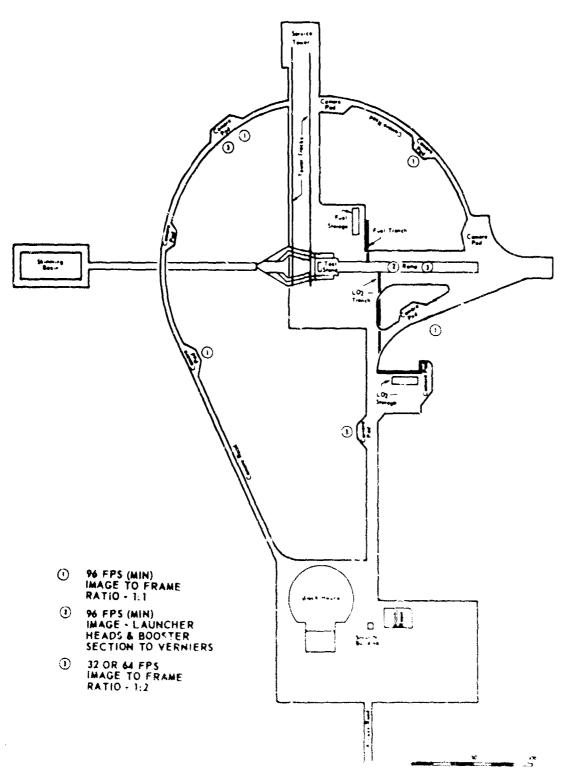
LAUNCHER INSTRUMENTATION

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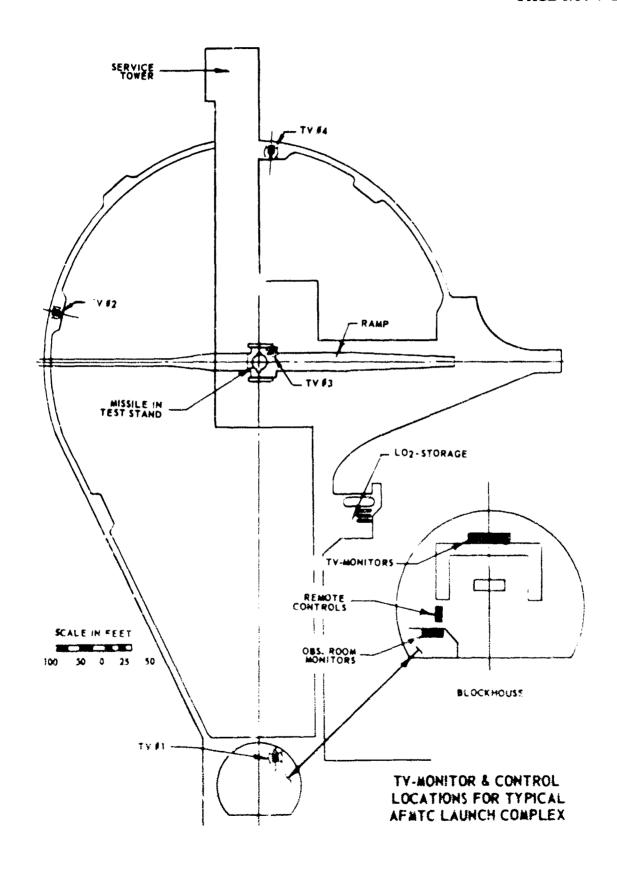
PAGE NO. 7-26



TYPICAL WS 107A-1 LAUNCH COMPLEX MINIMUM ENGINEERING CAMERA COVERAGE

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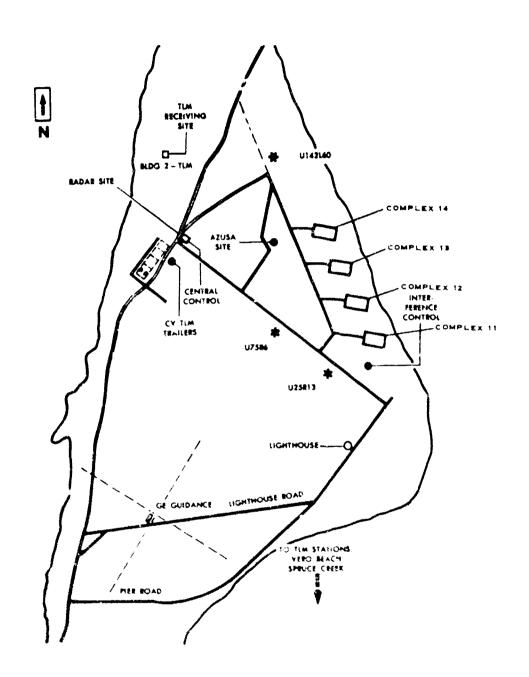
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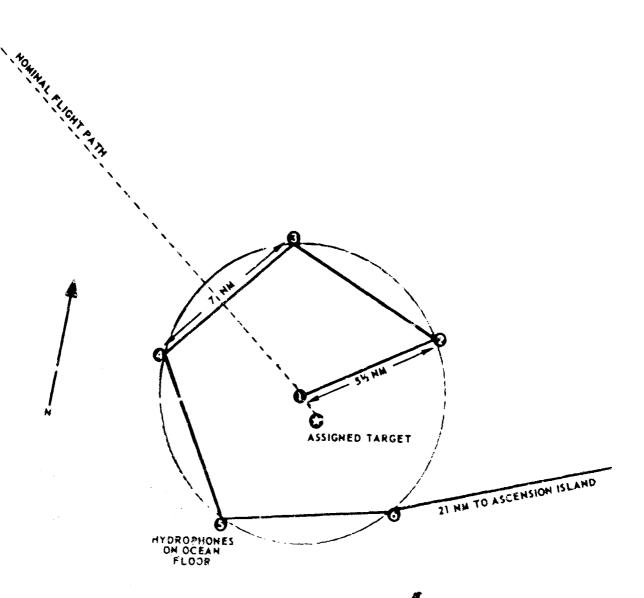
* TYPICAL CAMERA LOCATION MINIMUM FRAME RATE 32 FPS IMAGE TO FRAME RATIO PRIOR TO LIFT-OFF 1:2

TYPICAL TRACKING CAMERA COVERAGE (MINIMUM ENGINEERING REQUIREMENTS)

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ASCENSION ISLAND SPLASH NET (MILS) INSTRUMENTATION

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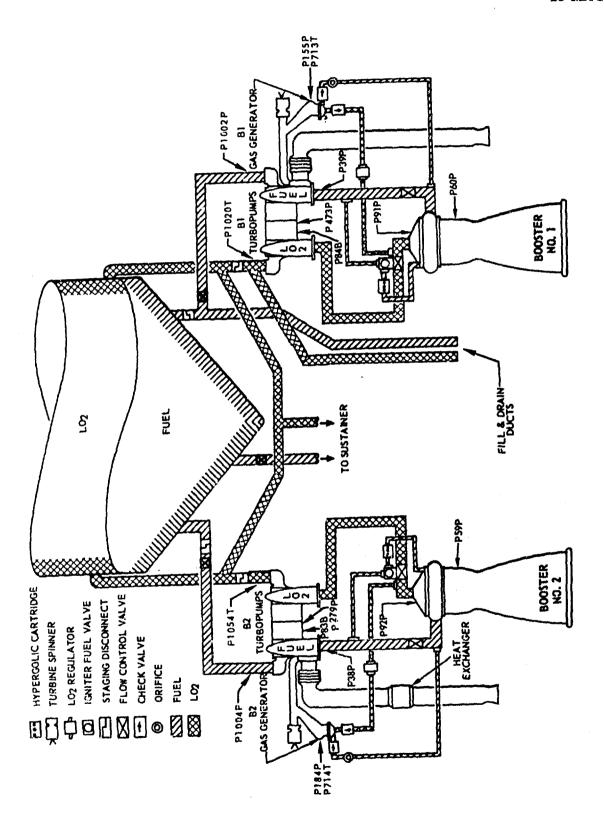
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15 MAY 1961



BOOSTER ENGINES

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15 MAY 1961 SENSOR STATION SWITCHING MATRIX LIQUID OXYCEN OSCILLATOR CIRCUIT FUEL OSCILLATOR LIQUID OXYGEN CIRCUIT SENSOR STATION CONTROL 3-STAGE COUNTER LIQUID OXYGEN SENSON-STILL -WELL ASSEM-BLY INTEGRATING INTEGRATING CIRCUIT CIRCUIT REMOTE RESET) SCHMITT SCHMITT U 1122X 6 VARIABLE VARIABLE DELAY DELAY 圭 MONOSTABLE MONOSTABLE MULTIVIBRATOR MULTIVIBRATOR (12 SEC) U1158X . FUEL TANK OR GATE INHIBIT GATE PUEL SENSOR STILL-WELL ASSEM-BLY VFG CONTROL COMPUTER RESETI ERROR SENSE BISTABLE MULTIVIBRATOR ERROR TIME RESET GATE BISTABLE MULTIBRATOR OP GATE" VARIABLE FREQUENCY ERROR TIME GATE OSCILLA OR (VFD) RESET 7-STAGE (COMPUTER RESET) COUNTER LIMIT COUNT GATE (COMPUTER RESET) CONVERTER MIXTURE VALVE VDC FILTER VALVE POSITION DIFFERENTIAL PHASE AMPLIFIER **ADJUST** DETECTOR TRANSDUCES MATCHING TRANSDUCER DRIVER 400-CPS TRANSDUCER OSCILLATOR SUSTAINER ENGINE

THIS MATERIAL CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS, TITLE LZ, U.S.C., SECTIONS 797 AND 794, THE TRANSMISSION OR REVELATION OF WHICH IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW.

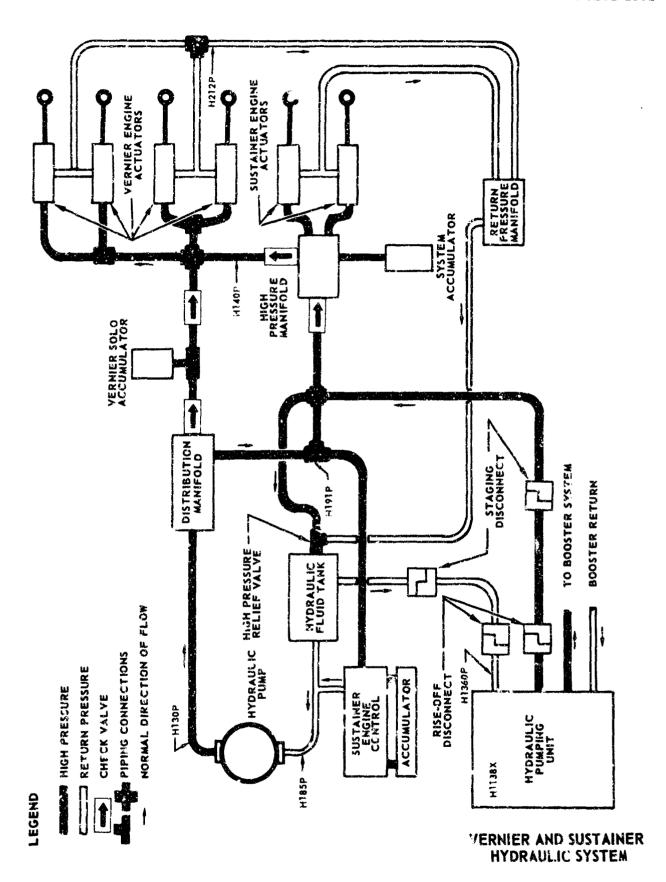
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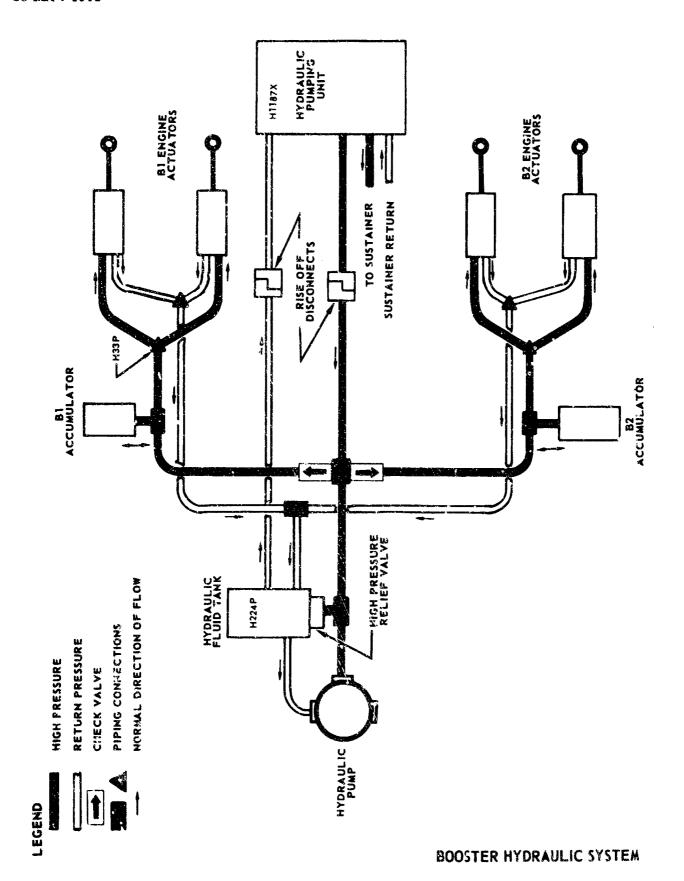
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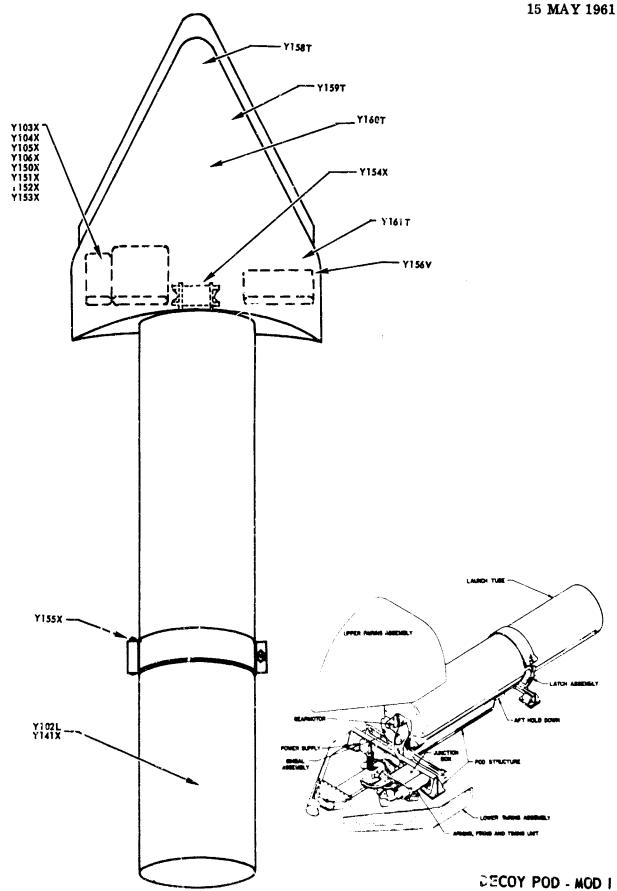


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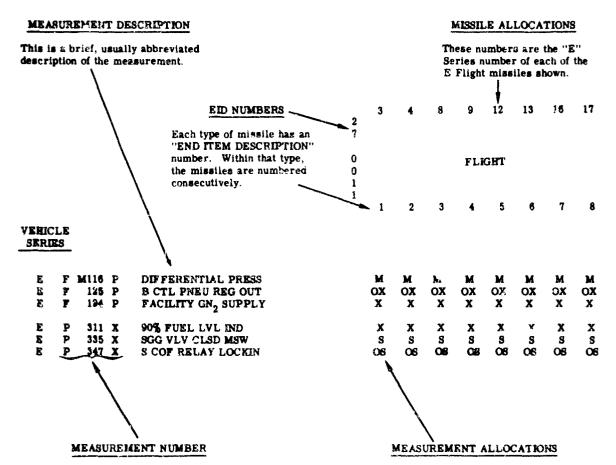


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SECTION 8

E FLIGHT INSTRUMENTATION COMPOSITE

The Missile Composite presented in this section contains the instrumentation planned at the time of publication of this report for the E Flight program. This tabulation is sorted by measurement system.



The letters under the missue numbers indicate the missiles on which timeasurement is instrumented. Each letter indicates a different means of instrumentation. The letter "O" is Telemetry, "X" is Landline, "M" is a panel meter and the "S" indicates Standard Sequence measurements.

NOTE: For a more detailed explanation of this format and a key to the abbreviations and coding see Appendix A of this report.

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SECTION 8

15 MAY 1961

REPORT NO. L -RED COMPOSITE

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SECTION 8

15 MAY 1961

ALPORT NO. E-RED COMPOSITE

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r	A			VZ CLAMSHELL INNER	2	11	49	0	15	PIA	5%	SLU			×		Ц.	\perp	L	Ц	Ц	_	\perp	Ц	1	Ĺ	1717
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Ī			П											Ц	1	\perp	Ц	1	L	Ц	Ц	4	1	Ц	_		
T		1	7	VZ FAIRING AMBIENT	3	11	23	0	1000	UGF	53	SLO		<u></u>	L	×	Ц	\perp	L	Ц		4	\downarrow	Ц	1		1717
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t	A			V2 C' ANSHELL ANB	3	11	31	0	1000	UGF	58	SLO		Ц	Ų.	•	Ц	Ĺ	L	Ц	Ц	4	_	Ц	_	Щ_	1717
T	A			VZ CLAMSHELL AMB	3	11	>3	0	1000	UGF	13	SLO		Ц	\perp	1_		4	L		Ц	4	\bot	Ц	_	Щ_	1810
1	A	3	7	V2 CONDUIT	3	11	33	0	1000	Dur	>3	SLO				•	Ц	\perp	L	L	Ц	_	1	Ц	_	1	1717
T	A		1	V2 SERVO ELEC CON	3	11	34	J	1000	061	3.	SLU		Ц	•	•	Ц	\perp	L		Ц	4	\bot	Ц	_	Щ_	171/
				ROD PANEL AMBIENT	3	11	23	0	1000	DGE	-58	SLO		Ц	Ь	1	Ц	\perp	L		Ц	_	1	Ц	1	Щ_	1717
T	1.		П	DUMMY ROD INNER A	,	11	,,		1000	UGA	L	اعدا		Ц	┵	$oldsymbol{\perp}$	Ц	\perp	L	Ц	Ц	\downarrow	\bot	Ц	╀		1672
T	T.			DUMMY ROD INNER B		1.1		٥		DGA	-	SLO		Ц,	↲	L	Ц	\perp		Ц	Ц	4	\bot	Ш	_	Щ_	1672
t	1		-	DUMMY ROD OBED MUT	,	11	10.2		-	OGE	68	S.C.		Ц	4	$oldsymbol{\perp}$	Ц	\perp	L		Ц	\perp	\bot	Ц	_	Щ.	1472
l	1			DUMMY RUD GUTER A	,	11	33		1000		48	SLU		Ц	_ֈ.		Ц		L		Ц	\bot	1	Ц		Щ.	1730
t	1		\Box	DUMMY ROD OUTER &			37		1000		53	SLU			<u>J.</u>		Ц	\perp			Ц	1	\perp	Ц	1	Щ.	1730
t	_ A		1	V-2 FAIRING AMBIENTS			T	0	1000	190	5%	SLU				L	Ц	L	<u>,</u>		Ц	1	┸	Ц	_		1910
t	1			V2 FAIRING AMBIENT 2			1	0	1000	منان	53	عدد			,	×	<u>Ll</u> ,	┵	L		Ц	\perp	\perp	Ц	\perp		1010
ŀ	A			V-2 CLAMSHELL COMPNT		ŀ	1	0	>00	UGF	43	SLO		Ш		L	Ц,	L	k		Ц	\perp	\perp	Ш	┸		1810
ı	A	21	7	V-2 FAIRING COMPONET	3	11	11	0	500	UUT	45	SLO		Ц	$oldsymbol{\perp}$	L	Ц	┸	L	×	Ц	1	丄	Ц	\bot	Щ.	1810
t	A	21	7	V-2 FAIRING COMPONET	3	11	41	0	>00	UGF	4%	SLO		Ц		\perp	L	┵	L	L	Ц	\bot	_	Ц	\bot	Щ.	1810
Ì	A			V-2 FAIRING COMPONET				111	500	111		1	616	Ц	┵	\downarrow	Ц	┸	k	L		4	1	\coprod			1818
t	A			MISSILE TK NR PB POU					>40	UG+	4.5	SLU	\parallel	Ц	1	\downarrow	\sqcup	\perp	x	\sqcup	A	x.	\downarrow	\coprod	_	₩_	1910
t	A		~	MISSILE TK NR PB POU		ļ	1	£ ! i	4	f 1 3	1	1	111	Ц	1	$oldsymbol{\perp}$	Ц	<u> </u>	L		Ц	4	1	\coprod	+	Щ_	1910
t	A		7	MISSILE TK NR PB POD	1			£ 1 1	1	{ } } }	1	1	111	Ц	\perp	\perp	Ц	\bot	ļ.	Ц	Ы	ᆚ	\downarrow	Ц	_	Щ.	1810
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ı	A		_	MISSILE TK HR PB PUD	1	1	1	111	1	111	1	SLO	111	Ц	1	\downarrow	Ц	\perp	Ł	Ц	×	ᆈ	1	\coprod			1616
1	A	_	_	MISSILE IK NR PB POU	ł	ı .		121	i	UGF	1	SLO	Щ_	Ц	\downarrow	\downarrow	Ц	<u> </u>	L	\sqcup	Ц	4	1	igspace	_		1810
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VENICLE	FE3.13	LASUPLINENT NOMBER	MEASURFIASHT	DESCRIPTION	Tue / REC	WECASINS/ PACE	100	ll .	EEWEHT 1864	Se Plectice	ACCURACT	B OF CALMER E PRECION F PERCION				131		41	11	21	2:	21	24	30	133	1	***	
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	A	44	Ţ	MISSILE TK NR PB POD	3	11	1	AMB	540	DG+	4%	SLO		T	П	1	T	T	Γ			×	×			T		1610
	A	44		MISSILE TK NR PB POD						OGF		SLO					I	I		Ä					I	I		1810
	A	44		MISSILE TK NR PB POD				AMB	540	DGF	48	SLO			Ц				×					Ц			Ш	1810
	A	45	T	MISSILE TK NR PH POD	3	11	3	AHB	540	UGF	48	SLO	<u> </u>	L	Ц	1	\perp	\perp	L	L	Ц	X	×	Ц	1	1	\coprod	1810
	A	. 45		MISSILE TK NR PB POD	3	11	53	AME	340	DGF	48.	sua	$\!\!\!\perp$	L	Ц	4	1	\perp	L	·	Ц	_		Ц	\bot	1	Ц	2020
	A	45	7	MISSILE TK NR PB POD	3	10	45	AMB	540	DGF	43	SLO	$\!\!\!\perp$	L	Ц	4	1	\perp	×		Ц			Ц	1	\downarrow	\sqcup	1810
	A	46	7	MISSILE TK MR ADF	3	11	17	0	1000	DG/c	48	SLO	Щ_	L	Ц	4	1	\downarrow	L	×		_		Ц	- -	×	\sqcup	1811
	A	46	7	MISSILE TK NR ADF	3	10	5	0	1000	DGF	43	SLO	Щ_	L	\sqcup	4	4	 -	×		Н	_		Н	4	_	\sqcup	1811
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	A	_47	7	MISSILE TK NR ADF	3	10	ա		1000	DGF	<u></u>	SLO	#_	-	Ц	4	4	‡	1		Н		Щ	\dashv	+	+	H	1811
	A	48	Ţ	MISSILE TK NR ADF	3	11	43	0	1000	DGF	4%	SLO	$\!$	L	Н	4	4	╀	L	X.	Н	_		dash	+	卆	H	1811
	A	48	<u>. </u>	MISSILE TK NR ACF	3.	10	3	0	1000	DGF	48	SLO	₩_	L	H	+	+	╀	X.	L	Ц	_		Н	+	╀	H	1811
-	A	49	7	MISSILE TK NR ADF	3	11	45	0	1000	DGF	48	SLO	₩-	L	H	+	+	+	L	X	Н	_		H	+	╀	H	1811
	A	49	T	MISSILE TK NR ADF	3	10	-1	0	1000	UGF	43	SLO	₩-	H	Н	+	+	╀	X.	H	\dashv	4	Н	H	+	╀	H	1911
	A	51	-	MISSILE IN NR AFSHC	د	11	21	0	>00	UGT	43	SLU	╟	H	H	+	+	╀	L	*	\dashv	×	۸	\dashv	+	+	H	1624
-	A	52	1	MISSILE IK NR AFSHC	3	ii.	23	0	>00	UGF	40	SLO	╟	H	\dashv	+	+	╀	H	X	\dashv	ᅬ	×	+	+	╀	H	1822
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	•	-54	- ∥	MISSILE TK HR AFSHC	3	11	40		-500	UGA	48	sia	╟	Н	Н	+	+	╀	-	×	\dashv	시	×	+	╁	+	H	1823
-	4	55	ᆚ	MISSILE IK NR AFSMC	3	11	32		500	DGE	-48-	sia	╟	Н	Н	+	╀	╀	H	×	+	4	×	\dashv	╁	╀	H	1833
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-	4	409	1	BLACK CALOR QUAD 1	3	11	11	0	1000	DGF	49	SLO	╟	×	শ	+	╁	\vdash	Н	Н	\dashv	┪	\dashv	+	十	╁	H	1637
-	4	409	┸╢				13		1000	DGF		SLO	╟	Н	H	4	+	H	Н	Н	+	+	\dashv	+	十	t	H	1734
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DATE 15 MAY 61 PAGE 004 DESCRIPTION 3 2 19 GM CALUR QUAD I 000 || DGF CABLEMY FRG COMP AME 500 1822 CABLEMY FRG COMP AHE 3 10 500 OGF 452 T B1 POD AMBIENT 500 DGF B2 POD AMBIENT 458 T AIG POD AMBIENT 500 1500 DGR 461 T VI HEAT SHIELD 1000 DGF 862 464 T THRST STRUCTURE SKIN 3 DGF 862 842 473 T WHEAT SHIELD OUTER DGF 862 479 T ADAPTER SECT AMBIENT 500 UGF 1822 479 T ADAPTER SECT AMBIENT >00 OGF 862 AMB F STG VLV US שטעון ססב 645 T AMB FWD 81 04 1023 666 T ADAPT SKIN FWD 500 1800 DGR 667 T ADAPT SKIN CTR 500 52 862 668 T ADAPT SKIN AFT 500 1800 DGR SLU 862 671 T 83 FWD WRG-TBG FRG 500 1800 DGR SLO 862 T FWD WRG-THG FRG 200 1600 862 676 T V2 FRG FWD 500 LAGO Drive 862 677 T V2 FRU CIN 1800 うのひ 862 678 T V2 FRU SIDE 842 679 T V2 FRG AFT 482 T #1 AIG POD INSUL OUT 500 1500 DGR 3 11 500 1500 ||ogx

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	T ELIANS	MEATUREMEN	TTPE MEASURE	DESCRIPTION	TLM / R	MANON	LOW	HISH	OF FUNC	ACCUPACI	DATE OF CHANGE OR PREQUENCY OF PUNCTION	2	3	4 4	310	2	411	ž.	1.4	14	141	310	36	14	
	A	694	+	#2 AIG POD INSUL OUT	3 1	15	500	1500	DGR	40	SLO				х	x x	T				1				862
	A	685	T	#2 AIG POD INSUL IN	3 1	17	500	1500	DGR	40	SLO				x	х ,	\perp			\perp	\perp	L			862
Ĺ	A	686	T	#3 AIG POD INSUL OUT	3 11	19	500	1500	DGK	+0	SLO	$ lap{}$			x	XX				\perp	\perp	L			862
	A	687	7	#3 AIG POD INSUL IN	3 1	21	500	1500	DGR	40	SLO				x	X)									862
	A	688	7	#4 AIG POD INSUL OUT	3 11	23	500	1500	JUNE	<u>.</u>	SLO				¥	y ,									862
ſ	A			#4 AIG POD INSUL IN	3 11	43		1500		40	SLO				x	X					and and and				842
ſ	A	690	Т	#5 AIG POD INSUL GUT	3 11	45	500	1500	DGH	40	SLO				X	XX									862
	A	691	7	M5 AIG POD INSUL IN-	3 11	47	500	1500	DGR	40	SLO				х	XX									862
ſ	A	692	7	BI NACELLE INSUL FWD	3 10	19	500	1500	DGR	40	SLO				x	X X									862
Γ	A			B2 NACELLE INSUL FWD	3 10	21	00د		UGK	40	SLO				x	XX	Ī								862
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	A			B2 NACELLE INSUL CTR		1 7		1500			SLO				x	xx			Ī	T	T				862
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- -		1807		ROT INVTH B2 POD G2	My		30	240		4 8			Ĵ				П	T	+	†	П	1	十	╫	1753
卜		1808		RUT INVTH B2 POD Q2	MP		30	111	UGF	48 5			×			×	H	十	T	十	Н	1	T	╫	1751
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\vdash	-			ROT INVTR 82 POD U2	MP			240			- 1		X		+	1		十	†	†	H	†	+	╫	1753
十				ROT INVTR B2 POD Q2	мр			240	1				x		+	1	1	十	T	†	П	†	十	₩	1753
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+				A/P GYRO GROUP YY	MP		30	180		4 × S	111	+	×	++	+	T	十	+	\dagger	H	+	+	+	Ш	1751
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_	Т			GE P8 81 POD Q4		MP		30	180	DGF	4%	SLO	L	L	x	_	1	L	x	4	4	4	4	4	lacksquare	ot	\sqcup	17
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A	1	902	7	GE PB 81 POD Q4	L	MP		30	180	DGF	48	SLO	L	L	X	\perp	4	4	×			_	\sqcup	+	╄	╀	+	17
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,	1	909	7	GE PB B1 POD Q4		MP	1_	30	180	DGF	4%	SLO	Щ_	\downarrow	X	Щ	4	\bot	×	Ц		L	\sqcup	+	+	\downarrow	+	17
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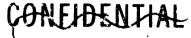
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REPORT NO E-RED COMPOSITE

DATE 15 MAY 61	FAGE QQB
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REPORT NO. AZC-27-059

SECTION 8

15 MAY 1961

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DATE 15 MAY 61 *AGE 009

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F	1301	ρ	GND LOX ULLAGE TANK		S		20	<u>د 3</u>	PIG	.1	SLO	X	x	XX	×	x x	X	×	XX	×	×	X	×	X	X	1466
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		П	ALG POD AIR INLET Q3						216	1			,							L		Ц	Ц			1347
	1828		ALL PULL ALK LINE LINE	П															\perp	L	L					
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- F		T	FUEL PRESS ORIFIC IN	-					1		SLO						Ļ									1640
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i F	375	1	LOX TK ULG STA 827	3	11	3	150	1050	DGR	48	550	<u>! </u>	4-	+	 		×		+	+	Н	\dashv	\dashv	-	╫	1705
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F 326 T	LOX TK ULG STA 846	3	11	43	150	1050	DGR	4%	SLO								x								1776
p 376	LOX TK ULG STA 846	3	10	47	150	1050	DGR	4%	SLO							×		T	T		Γ	П		\parallel	1705
5 377 F	LOX TK ULG STA 867	3	11	45	150	1050	DGR	4%	SLO		[]	T				T	x		T		T	П	T	\parallel	1776
F 337 7	LON IN ULG STA BAT	2	10		150	1050	068	4.04	51.0					Ţ				T	T	T	T	П		#	
F 771 T	LOX TK HE INLET	1	•	1		1000		4	SLO			7				x x	Ţ		1	Ť	<u> </u>		+	#	1660
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	LOX TK ULG STA 630	-		49		1050	Duk	4%	SLO	╫	H	+	+	┼-	+	+	X	╀	╁	 	\vdash	H	+	₩	1776
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	LOX TK ULG STA 660	3	11	35	150	1050	DGR	4%	SLO	₩-	\vdash	_	-	 	4	_ X	X	X	1	<u> </u>		\vdash	\perp	#	1123
F 777 T	LOX TK ULG STA 650	3	11	37	150	1050	DGR	4%	SLO	╢_	\vdash	4	4		4	4	\downarrow	Ļ	L	L	Ш		\perp	Щ.	1660
F 760 T	LOX TK ULG STA 720	3	11.	37.	150	1050	DGR	636	SLO	<u> </u> _	_	\downarrow	-		4	×	×	X.	igspace				_	\parallel	1123
F 780 T	LOX TK ULG STA 720	3	<u>.,</u>	39.	150	1:50	SGR	4%	sic	<u> </u> _		_	_		ړ ــــــــــــــــــــــــــــــــــــ	-	1	L						Ш.	1660
F 781 T	LOX TK ULG STA 740	2	11	51	150	1050	DGR	48	sic			\perp					l _x	L							1776
F 781 T	LOX TK ULG STA 740	3	ړم.	51	150	1050	DGR	4%	SLO			$oldsymbol{\perp}$													
F 782 T	LOX TK HLG STA 162	3		53	150	1050	DGR	4.8	sto						. [*		×]				T			1776
F 782 1	LOX IK ULG STA 762	<u>a</u>	ıa	53	_15	1050	DGR	۵%	SLC						,			Ī							- 1
F 783 T	LOX TK ULG STA 780	3	11	39	. 150	1050	DGF	4%								X	1	x				\top			1123
F 786 T	LOX TR ULG STA 640	3	11	41		1050			5_0				1		+	x		x	П			1	+	╫	ĺ
F 1827 T	AIG POD AIR INLET Q2	Ţ			30		DGF		SLO		x	1	1	1		Ť	 	<u>-</u>	+-+		П	+	+	111-	1123
F 1529 T	AIG POD AIR INLET Q3				30		DGF		sLO		x	\top	T		-		T					_		111	1347
1 1 1	EXHST AREA AMB TEMP	1			30		DGF		SLO		x	+	†		+	+ ·	-	-		-+		-	+	III	1347
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F 1338 7	POD AMB TEMP	+	+		30	60	DGF	2	SLO	-	X	+-	-	-		+	-	_	+	-	+	+		#	1347
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THIS MATERIAL CONTAINS IMPORMATION AFFECTING THE MATIGMAL DEFENSE OF THE UNITED STATES WITHIR THE MEANING OF THE ESPIONAGE LAWS, FITLE 18, U.S.C., SECTIONS 783 AND 798, THE THANSMITSIO. DE REVELATION OF WHICH IN FIT MANDER TO AN UNLITHORIZED PL. : IS PROVEDITED BY LAW

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3 2	EMENT.	3	MEASUREMENT		2	/	CHANNEL	MEASU	*: WBW *:	UNITS	¥Ç4	FREGUENCY FUNCTION		л л :		<u>-</u>	4,				- 4-	3.5	7					
VEMICLE	MEASUREMENT	2	TYPE MEAS	DESCRIPTION	TLK / MEC	SUBCARRIER	SOMM/C	LOW	HIEH	OF FUNC	ACCUIACI	IATE OF CO.	_	4 3	4	4 4	6	1 8	41	101	11	11		L	L	L	119	
f	84	64	7	FUEL TK HE SYA 925	1	11	17	M50	300	DGF	20	SLO				Ŧ		Н	+	×	1	F	-					1851
F	84	46	т	FUEL TK HE STA 945	1	11	33	M50	300	DGF	20	SLO								х		Γ	Γ					1851
F	8	45	7	FUEL TK HE STA 935	1	11	21	MSO	300	DGF	20	SLO								×								
G	30	02	c	PB-IP MODULATOR AVG	1	11	53	M1.7	٥	VDC	<u> </u>	SLO	x	x	x z	x x												1427
عال	5.5	26	دبا	MOD III MAGNETRON	1	11			0.9	MA	.03	su	x	x	x ,	, x	×	x	x J	, x	×	×		¥	x	x		90
G	5	04	c	CONNECTED TO 1 11 7	1	11	37			<u> </u>				L.		×	X	×	x ,	(x	x	x		х	x	x	Ш	OD
	_	_	_					<u> </u>		<u> </u>				<u> </u>			_		\perp				L		L			
G	50	22	Ε	MOD III RB RF OUTPUT	1	11	3	0	15	E	•45	SLO	×	х	x ,	x x	x	x	<u>x</u>	4	×	X	<u> </u>	x	х	X		00
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G		94	0	CROSS CONNECT THRU	1	c	23	 							x l	<u> x</u>		Ц			L	L						1400
G	-	4	o	CONNECTED TO 1 C 23	1	ç	25	 		-	ļ		<u> </u>		x >	(x					\downarrow	L	L				Ш	1400
G	9	4	2	CROSS CONNECT THRU	1	٥	31	 		L					x >	(x			\perp	\perp	1	Ĺ						
G	19	6	2	P8-IP RADIAL	1	۲	1	M15	15	G	5×	2KC	<u> </u>	Ц	\perp	\perp	\perp	×		\perp	L	L					Ш	1803
G	19	00	٥	CROSS CONNECT THRU	ı.	٥	7	L		ļ			╙-	Ц		\perp		×										1803
G	15	36	∥د	CONNECTED TO 1 C 7	1	ے	9	<u> </u>		<u> </u>				Ц	\perp	\downarrow	ļ.,	×										1803
4	19	26	ااد	CROSS CONNECT THRU	1	٠.	15	<u> </u>		ļ			Ĺ		_		<u> </u>	×		\perp	Ĺ	_					Ш	1009
عا	15	27	ո∥	EB-IP RADIAL	1	۲	\perp	MLS	15	6	5%	3KC	_		x ,	(x	<u> </u>			l	L	_	L					1400
G	_15	27 (4	CROSS CONNECT THRU	1	د	7	ļ		<u> </u>					x ,	L _x	Ļ				L	_						1400
G	19	27	Щ	CONNECTED TO 1 C 7	1	ے	اوا			<u> </u>				Ц	x l	L X			!		L	Ĺ					Ш	1400
G	19	7	o	CROSS CONNECT THRU	1	c	15	 		 					x /z	X	\perp		1	\perp	L					Ц		
G	58	37	о 	POD WAVEGUIDE	1	c	17	M15	15	G	5%	2KC	<u> </u> _				\perp	X_								Ц	Щ	1871
G	58	37	о С	CROSS CONNECT THRU	1	c	23	 		 					\downarrow	1	\perp	X	<u> </u>	\perp	\perp				Ц		Ш	1871
G	58	37	2	CONNECTED TO 1 C 23	ì	Ċ	25			 					_	-+-	L	X	1	\perp	-	Ļ	Ц				Ш	1871
G	58	37	ן כ	CROSS CONNECT THE	1	c	31	 		 					_	_	_	x	1	1		_	Ц	Ц		<u> </u>	Ш	1871
G	56	7 0	2	POD WAVEGUIDE	1	С	33	 		G		1KC	<u> </u> _		x x	×	L			1	_							1400
G	58	37	o	CROSS CONNECT THRU	1	c	39	 		<u> </u>				Ц	x x	×	_		1	1	1		Ц				Ш	1400
6	58	37	2	CONNECTED TO 1 C 39	1	c	41	 		<u> </u>			_		x x	X	1	Ц	_	1	L	L	\sqcup					1400
G	58	37	5	CROSS CONNECT THRU	1	c	47	 					<u> </u>		x x	x	_		\perp	1	_	L		 			Щ	
G	59	25 0	ا د	PB WAVEGUIDE RAD	1	c	33	M15	15	G	5%	2KC	_		_	1	<u> </u>	x	_	\perp	L	L				Ц		1871
, G	59	95 (2	CROSS CONNECT THRU	1	c	39	 					 	\sqcup	_	\perp	ļ.,	X	1	_		<u> </u> _					Ш	1871
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TEMELE	S 75 TEN	MEASUREME HUMBER	EASURE.	DESCRIPTION	7 / 860	•	3	RAN		FUNCTION	ACCURACY	OF CHA FREQUEN FUNCTIO	4	8	917	113	191	728	21	222	\perp	Ц	_	1	440	
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H		5.05	_	CROSS CONNECT THRU	 		47							\dagger	-	\dagger	,		1	+	1	-	+	\dagger		1871
-	G	242	J	CROSS CORNECT TIME	•		7								Í											
	G	588	ρ	WAVEGUIDE PRESSURE 1	1	12	7	0	20	PIA		SLO	x	X Z	(x	x										1400
	G			WAVEGUIDE PRESSURE 2			9	o	20	PIA		SLO	x	x :	××	х	\perp	_	Ц	\perp	\perp			\perp		1400
					Ц			<u> </u>		<u> </u>					_	! !					1		1	\downarrow	┪╢	
	G	281	v	RB REFLECT SET	1	11	49	M2.5	o	VDC		SLO	×	x	x x	x		-			-		-	+	44	1427
L	G	503	٧	MOD III PE AGC	1	11	17	0	M4.8	VDC	-15	5 LO	x	X	x x	X	x	K	X	×	X		x)	C X	+	90
L	G	503	V	CONNECTED TO 1 11 17	1	11	47	 		 	-		X	X	X X	X	x /	(X	X	,	X	\vdash	x)	<u>د x</u>	++	
L	G	503	V	MOD III PB AGC	1	11	47	0	M4.8	VDC	-15	SLO	-	\dashv	\perp	↓-	++	+-		X	+	\vdash	-	-	++	1886
L	G	579	V	MOD III RB AGC NO. 1	4	11	21	-			-	SLO	X	X	XX	X	X	X	X	2	(X	-	X 2	۲X	+	ao
L	G	579	Y	CONNECTED TO 1 11 21	4	11	51	 		 	-		X	۲	X X	×	X	C X	X	2	r X	-	X	K X	++	#
-	G	579	V	MOD III RB AGC NO.1	1	11	51	-				SLO		H	+	+-	++	+	+-	X	+	\vdash		+	+	1886
\vdash	H		-		+-	-	┼─	-		 	-		-	╁┪	+	+	H	+	+		+	+	\forall	+	++	#
-	H		ï	SUSTAINER HYD PUMP	1	13	T	M50		9			#-	-	×	-	H	+	+			+		+	+	1637
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\vdash	 u	1		B HYD PUMP DISCH	2	111	39	,	3500	PIA	2%	SLO	l x													1531
 	Н	Ī	ρ	B1 HYD ACCUMULATOR	Т		43	III	3500	111		Ĭ	Ш	×	• >	X	x	x x	Ĭ×.	x ;	K X		x	x x		QQ
T	Н	33	Т	B1 HYD ACCUMULATOR	T	T	33	Ш	3500	Hi	i	ł	III -		_				_		1	X			x	<u> </u>
T	H	1	Т	B2 HYD ACCUMULATOR	2],,	53	0	3590	PIA	2%	SLO	_x								\perp	_		\perp		1531
	н	52	ρ	S HYD ACCUMULATOR	1	4	3	0	3500	PIA	5%	SLO	 ×	•	1		-	_	\perp	\sqcup	_	-		_	<u> </u>	ļ
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16. U.S.C., SECTIONS 793 AND 794, THE TRANSLISSION OF STYLLATION OF WHICH IS 187 MANNES TO AN UNMATHORIZED PERSON IS PROMISTED BY LAW

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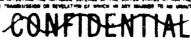
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_		REPORT	NO.	-RED COMPOSITE							DATE 15 MAY 61 PAGE 16																		
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MECRITAD E-RED COMPOSITE	-										DATI	1	5_H	AY.	61				i	AGI					L
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1 B43 V COMPUTER HEO PSUP	+	9		HSS	MAS	VOC		sco	₩	Ц×	×	×	x l	cل×	×	x l	ф×	×	Н	×	4	×	-#	- \$20	
I SAA V COMPUTER MIA-5 PSUP 1	4	2	39	M19	MIA	VOC.	-	sia	₩	ψх	×	×	×	ф×	×	×þ	ф×	×	$\left \cdot \right $	x l	ф	*	\parallel	-531	
1 545 V COMPUTER MIO PSUP 1	4	3 4	1	M12	M7.5	אסכ		SLO	₩×	· x	Į×.	×	×	фĸ	×	×þ	(x	Į×,	Ц	×	ф	4	#	_531	
1 547 V COMPUTER 4 PSUP 1	+	3 4	3	0	5	YDC		SLO	Щ×	Ųx.	X.	X	x x	Ųχ.	x	×ф	Цx	X	Н	χψ	ф	4	#	_531	
1 548 V COMPUTER 38 PSUP 1	\downarrow	Т	ı	0	76	VDC		SLO	Щx	×	x	х	x x	4	x	K Ja	Ц×	X.		Ų.	ф	4	#	330	
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I 580 V AZM RESOLVER SIG 2	1	1 3	1	M7.8	7.8	VAC		40	•		•	٦ (<u>L</u> A	X	X /	×	×	×	ا_	مل	4	4	#	00	
I 1601 V 400 CPS REFERENCE	4	-							X	X	X	•	×	_	X	×	\perp	x	x l	√ ×	×	×	╨-	897	
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THE MATERIAL CLUTTHIN INFORMATION AFFECTING THE INTERIOR AFFECTIVE BY WILL MATERIAL STATES WITHIN THE MILANDE OF THE ESPERANCE LAW S, TITLE 14. U.S.C., SECTIONS THE AND THE, THE TRANSMISSION ON RESIDENCE BY SHIPE IN ANY MANUEL TO AN AMAZING IS PROMISETED BY LAW CONFIDENCE TO AN AMAZING IS PROMISETED BY LAW.

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HOTH THE -RED COMPOSITE DATE 15 MAY 61 PAGE 19 SUBCARRER , DESCRIPTION COMM L 1462 P VENTRI PITOT TUBE TI 1753 L 1463 P VENTRI PITOT TUBE TZ 30 INW 0.2 1753 L 1464 P VENTRI PITOT TUBE T3 INW 0.2 1175 1465 P VENTRI PITOT TUBE T4 1753 1466 P WENTRE PLIOT TUBE 15 L 1450 T PORT THERM 1 1753 L 1451 T PORT THERM 2 60 DGF 1459 T PORT THERM 3 DGF 1460 T PORT THERM 4 T PORT THERM 1753 79 A MSL AXIAL ACCEL FINE 3 143 D BOOSTER SEPERATION 1151 M STAA V STROBEL IGHT BATTERY 32 X CONNECTED TO 1 A 23 78 X STROBE LIGHT OCCUR VDC 84 X B STEG LATCH MEW Q1 OFF 85 X B STGG LATCH MSW Q2 OF 1022 86 X B STGG LATCH MSW Q3 OFF 1022 87 X B STGG LATCH MSW 04 OFF M 1090 X MSL ONE INCH MOTION OFF N 5362 D 36 INCH WATER VALVE N 1517 N AFSWC POD LANYARD FPS 1843

1310 P SLUG CH LOZ DISCH

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PANTA .	TABLESCO.	NO PERSONAL PROPERTY AND PERSONAL PROPERTY PROPERTY AND PERSONAL P	Tring and administration of the	DESCRIPTION	Trial - Back	TRACK	COLUM / CHAMME	MEASUR RAH LOW		UNIT! OF FUNCTION	AUCURACY	OR FROUGHCT OF FUNCTION	4	8	91	1	41.6	1 8	18	2 1 2 1 C 2	12	1	1	L.	╽.	617	19	ill
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-	P	206	O	S ENG LOZ DOME	-		-	MBC	80	6	4	2KC	₩		-				+	i	1	Γ	X			+	+	178
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1	P	59	+	B2 THRUST CHAMBE".	1	-	7	₩	800	- 1 A	110	60	#	+-	$\dagger \dagger$	+	+	1-1	+	1	† .	†-		\vdash	+	-41	

THIS MATERIAL CONTAINS INFORMATION AFFECTING THE MATICIPAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPONANCE CARD, TISE
18 U.S.C. SECTEMES 793 AND 794. THE TRANSMISSION OR REVELATION OF WHICH IN ARY MEMBER TO SE UNMAITMORIZED PERSON IS PROMORIZED BY SAN

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Mewcus	SYSTEM	MELS SUBSEMBET	TYPE MEASUREMENT	DESCRIPTION	1134 / 8SC	SUBCARRER /	PIN CHANNEL	EAN LOW		UNITS OF FUNCTION	ACCURACY	BATE OF CHANGE OR PEGUNICT OF PURC - 19	4	8	112	131	.61	18	101	113	26:	1	323	L	Ш	
-	ρ	59	۵	CONNECTED TO 1 C 7	1	ζ	37									<u> </u>	+		+	-	,	x	1		X	
	F	59	P	B2 THRUST CHAMBER	2	E	1.1	0	800	PIA	18	60	×	x x	x	x ,	(x	X	r. X	x	x	,	K į X	x	14	00
	Р	59	ρ	CONNECTED TO 2 E 11	2	E	41						x	у у.	x	x ,	(x	x	x x	X	X.	_;	x x	x	11	
	P	60	P	B1 THRUST CHAMBER	1	c	5	0	800	PIA	18	60		_	 		_	\coprod	_	-		×	\downarrow	ļ	X	
L	P	04	P	CONNECTED TO 1 C 5	1		35							\perp	-		1	$\downarrow \downarrow$	\perp	\downarrow		×.	\perp	╽.	×	
	P	60	Р	B1 THRUST CHAMBER	2	£	9	0	800	AIG	18	60	X	۸X	X	x i	(x	x .	x x	X	x		x x	×	+-#	00
ļ	Р	60	P	COMMECTED TO 2 E 9	2	Ē	39			 			х	хх	X	X Z	(X	х	x x	X	X	1	хх	X	+-	
	ρ	91	ρ	B1 LO2 INJ MANIFOLD	1	13	39	0	1000	PIE	15	SLO	×	хх	X	X I	× ×	х	x x	×	X.	X	x x	×	X	OD
L	ρ	1091	Р	B1 LO2 INJ MANIFOLD		F			1500	PIA	75	1KC	 -	\vdash	+-	$ \downarrow $	-	\vdash	X X	×	×	×	<u> </u>	+	+	1768
	ρ	92	Р	B2 LOZ INJ MANIFOLD	1	13	15	0	1000	PIA	15	SLO	<u> </u>	x x	X	X	××	X	X X	X	X	X /	x x	X	X	OD
-	P	1092	P	BE LOZ INJ MANIFOLD	-	F		0	1500	PIA	75	1KC	₩.	1	+	-	+	\dashv	x ¦x	×	x	X X	<u> </u>	+	+	1728
L	P	1093	P	B1 FUEL INJ MANIFOLD	-	F		0	1500	PIA	75	1KC	 -		╁-	\dashv		-	x þ	×	X	X !	×	+	\dashv	1785
-	P	1094	Р	82 FUEL INJ MANIFOLD	_	F		0	1500	AIS	75	1KC	 	-	+	\downarrow	\dotplus	┦┪	x ;	×	X	X	×	+	\dashv	1788
L	P	155	ρ	B1 GAS GEN COMBUSTOR	1	12	23	0	1000	PIA	30	SLO	X	x x	×	X	x x	X	x)	×	X	-	XX	×	\dashv	1270
L	P	155	Р	B1 GAS GEN COMBUSTOR	1	13	41	0	1000	PIA	30	SLO	₩-	-	+-	\dashv	4.	\dashv		-	╁┥	×	\dotplus	-	×	
	2	184	Ρ.	BZ GAS GEN COMBUSTOR	1	12	33	0	1000	PIA	30	SLO	X.	ΧZ	X	x	x x	x	נוג	(x	X	4	X X	×	+	1270
-	P	186	P	S2 GAS GEN COMBUSTOR	1	13	43	0	1000	PIA	30	s.a.	#-		+	\vdash	\perp	H	-	+	+	×		+	×	
-	٥	185	9	S) TURBOPUND GEARBOX	2	11	40	∥_ •	-15	PIG	-5	SLO.	×		4-	\dashv	+	┤╌┥	-	+-	╀	-	+	+	+	1272
-	P	163	Đ.	82 TURBOPUMP GEARBOX	12	1.	51	 		210	-5	s.o.	×-		+	\vdash	+	+-		+	╁┪	_	+	+	\dashv	1272
-	þ	1232	٩	S LOZ SEAL CAVITY	-	٤	┼-	<u> </u> o	- 40	PIG	2	SLO.	×	x.		\dashv		+	-+	+	+	-	+	+	H	990
-	P	279	F	AZ LO PR LUB OIL MAN	1	11	11	ه ا	115	FIA	5	SLO		-	+	+		+	\dashv	+-	++	X	+	+	_ X_	
-	p	279	P	B2 LO PR LUB OIL MAN	2	11	43	•	125	PIA	5	SLO	X.	X)	X	×	x X	×	X /	s Jx	X	\dashv	X /Z	X	4-	1272
Ļ	þ	330	P	S FUEL PUMP DISCH	1	13	33	0	1500	PIA	38	540	₩-	++		╁╌╅	+	X	X !	(X	X	\dashv	X J	X	44	1756
-	P	-	1	S FUEL PUMP DISCH	1	1	49	1	1500	111		SLO	-	-	- -	╁┤	+	+-		-+-	¦	X		+	X	
-	Р	330	E)	S FUEL PUMP DISCH	2	Ε	3	0	1500	PIA	38	SLO	Ш	Γ	T					+	+		+	+	+-	- 65
-	P	330	P	CONNECTED TO 2 E 3	2	E	33	 	 	 	-	-	111	۱ ۲					+	+	+		1	+		
}	P	337	P	SGG LOZ INJ MAN	1	A	31	ill	1000	Π	1	1	III	X /	(X	X	XiA	X	X	(X	X	×	X /	(X		- 00
	P	-		111	7	T	1	111	1500	PIA	38	PP3	#-	++	+	-	+	+-	$\mid \cdot \mid$	+	+	X	-+	+	X	
-	P	243	P	S LUBE OIL MANIFOLD	2	11	47	311	1500	111	1	T	Ш		- T	: 1	- 1			1	1 1	j	X)			1272
	Р	351	P	S LOZ INJ MANIFOLD	1	13	49	11	1000	Ш	1]	Hi	1 1	- 1	1	- 1	!		i	1 1	1 [1	1	
-	D	5371	P	LOZ STORAGE TANK	+	M	4_	<u> </u>	50	PIG	.6	SLO	₩×	X	K X	×	X	X	X .	x x	×	X	X ?	X X	(X	#
,	ρ	1419	9	B1 GG LOX INJ MAN	+	C		111	1000)![7	1K	Ш	1 1	$\dot{+}$	+-	-	+	-	+	+-	H	-	+	+	1449
1	P	1420	P	B2 GG LOX INJ MAN	+)	₩ •	1000	PIA	20	1K	x	\dashv	+	+	-	+-	\vdash	+	-	\vdash	-	+	-	1449
ij						_[_	<u></u>		1	Ш	<u></u>		lil_	11	\perp			1.		⊥.		لــا		_		

THIS MATERIAL CONTAINS IMPORTATIVE AFFECTION THE MATERIAL OF THE WHITE STATES WITHIN THE SEAMING OF THE ESPIGAGE LAWS, TITIS, SECTIONS 789 AC. THE TRANSMISSION OR REVULATION OF WHICE IS NOT MANMER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAN

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VEKKUE	SYSTEM	MEASUREMENT WUNNER	EASUBERERT	DESCRIPTION	TLM / MBC	ATACK	CHANNEL		it will the	WHITS PURCTION	ACCURACY	OF CHANGE FREQUENCY FUNCTION		4 6	9 1	41	310	17	18	2 1 2	242	\$20	3(13:	3:	31	440	
,		ž,	E L		F	SUBCARESE	OK OX	row	нен	8	å	188		1	4	1	6	1	4	102	1	11	124	2.5	16	17	113	
	Ρ	5430	ρ	FUEL STORAGE TANK				0	10	PIG	.6	SLO	×	x	x x	×	x	x	x ;	()X	x x	×	×	×	×	'_ x	x	
	ρ	1465		S LO PR LUBE OIL MAN		s		0	400	PIG		SLO																778
	Р	473	ρ	B1 LO PR LUB OIL MAN	1	11	13	0	150	PIA	5	SLO										x					x	
	Р	473	Р	BI LO PR LUB OIL MAN	2	11	45	0	150	PIA	5	SLO	x	х	x x	х	x	x	x ,	(X	×	X		x	x	×		1272
	Р	474	Р	V CIL PRESS REG OUT	1		15		1000	PIA	40	s.o.	×	×	\perp		L			-	\perp						Ц	445
	Р	1474	Ρ	V CTL PRESS REG OUT		s		200	300	PIA	16	SLO	X	x	x x	×	X	x	x ,	(X	X	X	x	X	x	X	x	
	4						_	<u> </u>		ļ			 -		_	1	Ļ.		4	4	1	\perp	<u> </u>			_		
	Р	1030	Ť	BI LOZ PUMP INLET	_	s		M325	M275	DGF	1	sto	ļχ	x	x x	X	X	x	x	(x	X	X	X	x	x	X	x	1450
	P	1054	Ť	82 LOX PUMP INLET		Ş		M325	M275	DGF	1	SLO	X.	×	x x	X	X.	x	X 2	<u>د</u> لک	L x	×	X.	X	x	х	x	1650
	Р	1151	I	FUEL TK # STA 1043		S		Q.	200	DGF	5	SLO	e		_	\downarrow	_		\downarrow	4	┦-	ļ	_		Ц	Ш	Ш	1270
	Р	1325	Ţ	ENG COMP AMBIENT		\$	\square	M325	500	DGF	3_	SLO	×	×	x x	X	×	×	x >	(x	×	X	X.	х	x	X	X	643
	P	530	1	S LO2 PUMP INLET	ı	11	9	M300	M270	DGF		SLO	e	x	x x	X.	x	X	X 2	L X	Ųx.	X.	X.	X	X.	X	x.	QD
	Р	671	Ť	TH SECT AMB QUAD 4	è	11	39	M100	300	DGF		SLO	×	×	×	X	X	X .	× /	×	×	×	Ä	X	X	x	x	OD
-	8	709	Ţ	SGG COMBUSTOR	1	11	23	0	1500	DGF	38	SLO	₩.	\perp	\perp	+	ļ_	Ш	\downarrow	- -	+	-	χ,	Н		Щ	×	
	p	709	7	SGG COMBUSTOR	3	11	9	0	1500	DGF	38	SLO	×	×	x x	X	X	X	x >	X	X	X		×	X	×		1291
	Р	1710	ĭ	SE ENVIRONMENT		5		M325	500	DGF		SLO	X.	х	XX	X	X.	x.	X ?	L X	X	ă	X	X	X	X.	x	643
-	Q.	1711	I.	B1 NACELLE ANGIENT	_	_\$_		M325	-30c	DGF		sta	X.	×	× ×	×	x	×	x d	L x	×	X.	X.	×	X	×	x	643
-		1712	1	82 MACELLE AMBIENT		_\$.		M225	500	DGF		sto	X.	x	x x	×	×	×	ĸ J	ц×	×	×	×	×	x	×	×	643
	P	713	1	81 GAS GEN COMBUSTOR	1	11	10	 	1500	OGE	42.	sLo	-		+	+-	-		- -	+	+-	-	x	\vdash	\dashv		×	
	٤	713	ı	BY GAS GEN COMBUSTOR	3	11	5	₩ <u>-</u> -c-	1500	DGF		sia	X.	×	x x	×	x	×	x J	ф×	4	×		x	×	×		1291
	P	714	I	R2 GAS SEN COMBUSTOR	1	11	61	 0	1500	DGF_	<u> </u>	SLO	\parallel	$\left\{ -\right\}$		-	-	\vdash	+	+	+	H	x	\vdash			x	
	P	714	Ţ	B2 GAS GEN COMBUSTOR	3	11	7		1500	DGF	42	SLO	X	×	x x	×	X	X :	<u>x x</u>	X	X	X		X	X	X	$\left \cdot \right $	1291
H	+		-				-	 					-	\dashv	+	+	$\left \cdot \right $	+	+	+	+	1				_	├┼╢	
H	Р	5849	W	LO2 SLUG XFER & FIRE	\vdash	M	-+			-			X-	X	x x	X	×	X	K X	X	X	X	X	X	X	×	×	
H	+	,,,,,	_	OBSERVED SUTOSS				055	0				-		+	+			+	1.	+				\dashv	\dashv		<u> </u>
	7		- 1	OBSERVER CUTOFF		R		 	ON	VDC		T	1		X X				\neg	T	1				7		1 11	535
	T			TCC STARY SWITCH		R			ON	VDC		STP	Π_	T	7	Т			Т	ī	Т							535
				THE PROPERTY CONTROL BEADY	H	R			ON	VDC		STP	1		7 ~				7	_	1							535
	7		- 11	ENGINE CONTROL READY		R		<u> </u>	ON	VDC		STP	1	П	T			^ /	1	+	 	^	^	-	^	^		1403
	7		- 1	PNEUMATICS CUTOFF		R		i		VDC		STP		\Box	X	\top	H	+	+	+	+-	-	\vdash	\vdash	-+	-	-	1403
\Box	7					<u>R</u>			04	VDC		STP			X	T			+	+-	+	-	Н	\dashv	+	-	-	1403
			- 1	IGHITER FUEL PURGE		R				VDC		STP	_		X				+	-	+	-	H					1403
\mathbb{H}'	-	1554	-	LOX HIGH TOPPING		R	 	OFF	× -	VQC		\$TP	<u>*</u>	Ť	* X	X		X /	X	X	X	X	Δ	Ă	X	X	×	1415

THIS INCTERNAL CONTAINS IMPORTATION APPECTING THE MATIQUES BAPEFING OF THE CONTROL STATES WITHIN THE MATERIAL OF THE COMMONS LAWS, TYPES THE U.S.C., SECTIONS 783 AND 794, THE THANSBURSION OR RE-SEATION OF WATCH IN ANY MANNER TO AN MEMATTHEMENES PORSON IS PROMISETED BY CASE.

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3	į		V	DESCRIPTION	7 880		30		H68	PUNCTION	ACCUBACT	OF CHANGE PREQUENCY PUNCTION		1	42	41	116	11	182	12	23	26	30	343	143	44	
ľ	٦	3"	TYPE DE		2	SECAL	8	LOW	нен	8	ą	1000		1	4	4	1	e	91	dī.	112	1.4	14	152	. 61	719	
F	H					-		#					#	H	+	‡		H	+	‡	-	H	_	1	‡	\mp	
	P	1230	X	LOX LOW TOPFING	_	R	$ar{ }$	OFF	ON	VDC		STP	X	×	<u>^ </u>	×	X	x	x x	X	X	x	×	x /	(X	×	1415
-	P	1231	X	LOX 100% SLUG COM	L	R	\vdash	OFF	ON	VDC		STP	X	X	X X	X	X	х	x x	X	X	×	X	x)	(×	×	1415
-	P	347	X	S CUTOFF RELAY	1	13	9	0	28	VDC		STP	X	×	X X	× ×	X	x	x x	*	X	X	×	X /	(x	. x	00
-	P	1347	X	S CUTOFF RELAY	-	R		OFF	ON	VDC		STP	×	X	X >	×	X	X	x x	×	X	X	X	X ?	(x	×	#
-	9	1544	r	VERNIER CONTROL	L	R		OFF	ON	VOC.		STP	×	x	x l	×	X.	×	×	×	×	х	×	x J	LX	×	535
-	ρ	1545	X	S IGN STAGE CONTROL	L	R	1	OFF	ON	VDC		STP	X	×	X X	×	X	X	x x	X	X	x	X	x >	C X	x	535
\perp	ρ	1546	×	B2 CUTOFF RELAY	<u> </u>	R	-	OFF	QN	VDC		STP	×	X	X X	X	×	х	x x	x	X	x	X	x >	(x	×	535
-	Р	547	X	B1 CUTOFF RELAY	1	7	s	0	28	VDC		STP	X	X	X X	x	X	x	x x	X	X	x	X	x ,	(X	x	535
-	Ρ	1547	X	B1 CUTOFF RELAY	-	R		OFF	ON	VDC		STP	X	х	X X	×	X	× .	x x	x	X	x	×	x	ф	!! 444	
-	Ρ	540	X	COMPLETE COF RELAY	1	13	5	ջ	28	VDC		STP	X	x	X X	Ųx.	x	x	x x	X	X	X	X	x >	(X	_ x _	535
L	Р	1548	X	COMPLETE COF RELAY	-	R	\sqcup	OFF	ON	VDC		STP	×	X	X >	x	X	x	x x	X	X.	x	x	x >	(x	x	
L	٩	1549	X	IGNITION START	<u> </u>	R		OFF	ON	VDC		STP	x	x	x >	<u>x</u>	x	x	x x	×	x	X	4	x >	(x	لعل	535
	Ρ	1598	X	VERNIER CUTOFF RELAY	Ļ.	R		OFF	ON	VDC		STP	<u> </u>		,	4			\perp		_		_	\perp	1	\perp	1468
L	ρ	1688	x	VERNJER ENG PURGE	L.	R		OFF	CN	VDC		STP			,	4				1	<u> </u>			_	\downarrow	\perp	1466
-	ρ	1785	X	B SECONDARY SHUTDOWN	_	R	1_1	OFF	ON	VDC		STP	x	x	,	4		Ц	_	_	L		\downarrow	_	1		1322
					L.	<u> </u>		 		ļ				_	<u></u> ,	_	<u> </u>	Ц	_	1	<u> </u>		_		_	$oxed{oxed}$	
	s	61_	۵	BOLL DISPL GYRO SIG	1	_	8	M3	3	DEG	-2	15	×	x	x x	Jx.	x	x	x x	×	×	Χ.,	إخ	x ,	x ب	Lx.	مم
	s	61	۵	CONNECTED TO 1 A 9	1		39	 		 			×	X.	x .	L x	x	x	×	یر	x	×	_	x ,	يل		
L	s	62	۵	PITCH DISPL GYRO SIG	13		11	EM.		DEG	.2	15	×	x	x x	x	×	x	x x	1	x	x	x	x J	لx ل	x	
L	s	<u>_62</u> .	۵	CONNECTED TO 1 A 11	1		63	 		<u> </u>			x	x	X	علا	X.	x	x x	×	x.	x		x ,	L X		
	s	63	۵	YAM DISPL GYRO SIG	,	A	13	МЗ	3	DEG	.2	15	_K	х	X X	L X	X.	x	X X	X	4	x	x.	X V	يل	X	00
	S	63	٥	CROSS CONNECT	1	A	43			<u> </u>			x	x	XX	x	x	x	x x	x	Х	x	_	x >	(x		
	s	203	٥	B1 PITCH ROLL	1	7		M5	5	DEG	,5	30	x	x	x x	×	X	x	x x	x	X	x	x	x x	(X	x	419
	5	203	٥	B1 PITCH ROLL	2	11	7	M5	5	DEG	۰,5	30	x	х	y.)	x	X										419
	5	204	0	82 PITCH ROLL	1	c	11	M.5	5	DEG	.5	30											x			x	
	5	204	D	CONNECTED TO 1 C 11	1	c	41										ļ.,						x			X	
	s	204	0	B2 PITCH ROLL	2	Ε	15	M5	5	DEG	.5	30	X	x	X	х	X	X.	x x	x	X	x		x x	(x		OΟ
L	s	204	D	CONNECTED TO 2 E 15	2	E	45						×	x	x x	X	x	x	x x	X	x	х		X X	X		
	5	205	D	81 YAW	1	6		M5	5	DEG	• 5		П	1	Τ[T	Ţ	T		1	T		T	1	7	11	419
	s	205	D	B1 YAW	2	11	5	M5	[DEG		ļ į	П			T	Ţ							I			419
	s	206	D	B2 YAW	1	ے	15	II		DEG		3Q	11		_T _L					Γ			X	T		X	
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SYSTEM		MEASUREMENT	TYPE MEASUREMENT	DESCRIPTION	TUM / BEC	SUBCARRIER /	COMM CKANNEL	MEASU!	1	UNITS OF FUNCTION	ACCURACY	RATE OF CHANGE OR PREQUENCY OF PUNCTION	4	8	91	21	116	17	182	01		ì		1	34	- 1	- 111	
s	1	206	D	CONNECTED TO 2 E 19	2	Ε	49						X	x	x ,	(x	x	x	x ×	(x	X	x		x	X Z	×	-#	
s	!	222	D	VI PITCH	1	c	23	0	50	DEG	5%	10			_	\downarrow	+		\dashv	+	+	+	×		+	-	×	
s		222	0	CONNECTED TO 1 C 23	1	C	53	ļ		#			_		-		╁		+	+	+	╀	X		$\vdash \downarrow$	-	×₩	{
s	,	222	D	V1 PITCH	2	E	7	0	50	DEG	5%	10	X	X	X :	x x	X	X	x >	(X	X	X	\vdash	X	X :	X	$-\!$	419
s		332		CONNECTED TO 2 E 7	2	Æ	37	ļ			! 		×	x	x	x x	×	×	x l	4	dx	×	-	X.	7	×	-#	
s	3	223	D	V2 PITCH	1	٥	1	<u> </u> _ o	50	DEG	5%	10	-	-		+	╁	H	+	+	+	+	X.	-	\vdash	-	X	
S	5	223	D	CONNECTED TO 1 C 1	1	c	31	l	ļ	 			-	H	-	+	+	-	\dashv	+	+	+	X	-	\vdash	-	×	
S	5	223	D	V2 PITCH	2	Ε	5	<u> 0</u>	50	DEG	5%	10	X	X	X	<u>, 'X</u>	X	X	X /	<u> </u>	()×	X	+	X	X	X		419
5	5	223	D	CONNECTED TO 2 E 5	2	E	35	 		 -			×	X	x	XX	X	X	Х	<u> </u>	Ψ	×	+-	X	X	X.		
Ļķ	5	233	D	V1 YAW ROLL	1	c	9	M72	70	DEG	7	10	∦-	-	\vdash	+	+	├-	\vdash		+	+	X	-	 - 		 * 	
	5	233	0	CONNECTED TO 1 C 9	i	5	39	 		₩			#-	-	H	+	+	-	\vdash	+		+	X	-	\vdash	<u> </u>	X	
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	5	233	٥	CONNECTED TO 2 E 13	2	E	43		ļ	₩			H×.	X	X	XX	×	X	×	x)	X (<u> </u>	+	X	X	X		
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	s	234	D	CONNECTED TO 1 C 13	1	٩	43		 	₩	 	-	#-	+	+-+	+	+	-	+ +	+	+	+	×	-	+-	-	X	
	s	234	D	V2 YAW ROLL	2	E	17	M70	70	DEG	7	10	X	X	X	X D	< X	X	Х	X.	ΧŲ	8 2	+	X	X	X	┼┼┼	419
1	<u>s</u> _	234	0	CONNECTED TO 2 E 17	2	E	4.7	₩		₩	ļ	-	×	×	×	x v	(x	×	×	×	x	4	-	×	×	×	-	
	s.	256	0	SUSTAINER YAW	1	4	+-	M3.0	3.0	DEG	+3	30	x	x	×	×	(x	×	×	×	צ.	٠,٠	×	×	×	*	x	419
Ц	S	-254	۵.	SUSTAINER YAW	12	11	1	M3-0	3.0	DEG	3	30	×	×	1	x	<u>د</u> ل×	+	\vdash	+	+	+	+-	╀	+-	 	+-+	419
	s_	257	٥	SUSTAINER PLICH	1	=	4-	M3+0	3.0	DEG	↓ •3	30	×	×	х.	X	C X	1	×	X	X .	x)	Ų x	.lx	×	¥.	×	419
	<u>s</u> .	257	ם	SUSTAINER PITCH	2	ļu	13	M3.0	3.0	DEG	-3	30	Ш		1		- 1	+	1-1	-	+	-	+	-	+	-	+-+	419
-	5_	5358	0	ROLL PROGRAM REAL T	-	+ *	' —	₩	 -	₩	 	 	X	X	×.	X /	X	X	X	X	X	X)	(X	×	X	X	X	
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	5	5.3	R	PITCH RATE GYRO SIG	1	- 9	-	M6		D/5			III.	X	X	•	? X	X	X	X	A	X)		1	X	X		00
-	5	5 :	R	PITCH RATE GYRO SIG	1	+-	1 23	M 5	6	0/3	• 3	15	-	+	+-	+ +	+	+	-	+		+	X	1	-	 -	X	ļ
	5	5	} ¦R	CONNECTED TO 1 A 23	1	1.	4 53	₩	· † · · · · · ·	# -	+		#	-	- 	-	-	+	 -			+	X	i	+	+	. X	_
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_	5	54	R	YAW RATE GYPO SIG	1	4.	8	Mr.	i	J D / S	1		11			1 1			i			÷			1		- 11	90
	S	54	R	YAW RATE GYRO SIG		1	1 9	M.	2	0/5	نه له	15		2 <u>X</u>	X	2	2	(X	×	<u>X</u> .	X.	Χ.	X :	X	X	X	-	<u> </u>
1	-	<u> </u>	+	171	-	ļ	-	Щ	-	11	+	+	#	-	+	-	+	-	+	-		-		+	+	-	+	 -
1	5	104	<u>.</u> įv	PROGRAMMER PITCH SI	6	<u> </u>	ט	د ــــــــــــــــــــــــــــــــــــ	2 2.1	VAC	نفيا	2 SLU	1112	(X	X	X	X /	X	X	X	X	X	X. /	Ų	L,X		, X ,	00

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	5	110	, ,	,	B1 PCH ACTR FEEDBACK		D	† —	H12	12	VAC	5%	10	₩,			-	L	J	_		_	-	+	+	+	+	\vdash	H	
		ŀ	!	- 11	B2 PCH ACTR FEEDBACK		٥		M12		VAC	5%		Ш	- 1	1	1	ļ	!!			- 1	- [1	T	T	T			00
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				- 11	PITCH GYRO AMP OUT		٥				VAC	59	30	I	į.	i				×		Ţ	Ī	Ţ	Т		X		X	40
1 1			-	-111	YAW GYRO AMP OUT		D		M10		VAC		30	Ш	Т	Γ				X.	7	Т	ЧХ	1	T		X	X	X	_ CD
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REPORT NO. AZC-27-059

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15 MAY 1961

FIRST NO E-RED COMPOSITE

SEPERATION SIG

BAROSWITCH 104 X TIMER START

DATE 15 MAY 61 PAGE ____ 29_ DESCRIPTION BANGS AA SCHMITT TRIGGER 134 X AA TIME SHARD OSC OP VDC 135 X AA SENSORS SIG 10% 135 X AA SENSORS SIG VDC 10% OFF U 1000 X LOX 100% SLUG COF-1 789 OFF U 1201 X LOX TOPG HI CTL-1 VDC U 1202 X LOX TOPE LO CTL-789 1203 X LOX 95% RAPID LOAD-799 OFF U 1204 X FUEL 100% SEC CT VOC U 1205 X FUEL 100% PRI CT OFF VDC U 1206 X FUEL 95% SEC CTL OFF Voc NO 789 lvoc U 1207 X FUEL 95% PRI CTL 789 VOC U 1208 X | LOX 100% SLUG COF-2 R OFF U 1209 X LOX TOPG HI CTL-2 VDC 158 T TEMP B IN FAIRING 159 T TEMP & IN FAIRING TEMP D IN FAIRING T TEMP A IN FAIRING 156 V BATTERY VOLTAGE

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SECTION 8

15 MAY 1961

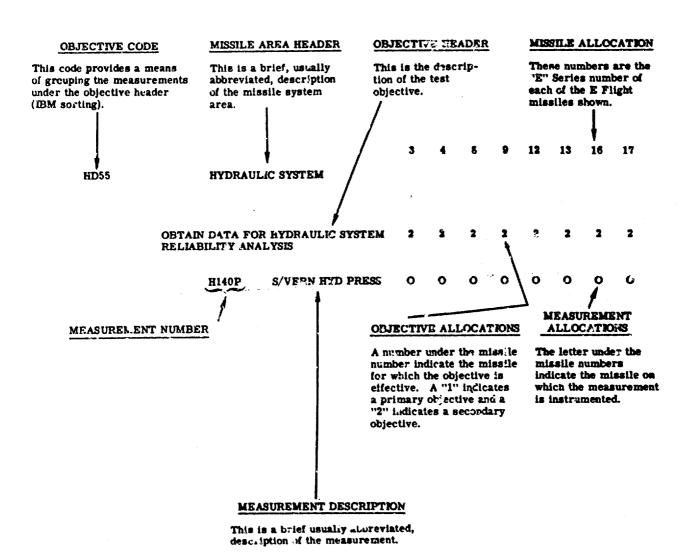
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CONVAIR-ASTRONAUTICS

SECTION 9

E FLIGHT OBJECTIVE COMPOSITE

This section presents a grouping of the measurements which support each test objective presently scheduled for the E Flight Program.



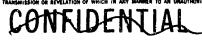
NGTE: For a more detailed explanation of this format and a Key to the abbreviations and coding see Appendix A.

SECTION 9

15 MAY 1961

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WE52	EVALUATE WEAPO PERFORMANCE ON RANGE.	ON SYSTEM VER INTERMEDIATE	1	1	1		1	ı				1	1		2				1		1		
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SECTION 9

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WC 62	EVALUATE WEAPON SYSTEM PERFORMANCE #ITH FLAT TRAJECTORY							1				1									
	x 0000 x NO SPECIFIC INSTR.						0	0				0									
WE63	EVALUATE WEAPON SYSTEM PER: PMANCE WITH FLAT MAX- HEAT: 3 TRAJECTORY-														1						
	X JOOO X NO SPECIFIC INSTR.														0						
	MISSILE STRUCTURE SYSTEM																				
AE51	OBTAIN DATA FOR ANALYSIS OF MISSILE STRUCTURE SYSTEM PERFORMANCE REPEATABILITY.	1	1	1	1	1	٦	2	2	2	2	2	2	2	2	2	2	2	2		
	F 1 P LO2 TANK HELIUM	O	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	٥		
	F 3 P FUEL TANK HELIUM	0	0	0	0	0	0	0	0	0	0	0	0	0	۵	0	0	C	0		
	I 513 A ACCEL XF1 DIRECT	0	0	0	0	O	0	0	0	0	٥	0	Э	0		0	0	0			
	I 514 A ACCEL XFZ DIRECT	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0			
	I 516 A ACCELEROMETER YF1	0	0	0	0	0	0	0	0	0	0	С	0	0		0	0	0			
	I 517 A ACCELEROMETER 2F1	0	0	0	0	0	0	0	0	0	O	0	0	0		0	С	0			
	I 519 A ACCELEROMETER YF2	0	0	0	0	0	0	0	0	0	0	0	0	0		0	Q	0			
	I 520 A ACCELEROMETER Z+2	0	С	0	0	û	0	0	0	0	э	0	0	O		0	o	0			
	M 143 D BOOSTER SEPARATION	0	0	0	0		0	0													
AE53	OBTAIN DATA ON AERODYNAMIC 6/ OR ENVIRONMENTAL HEATING FOR SELECTED LOCATIONS	î	2	1	1	2	2	2	2	2	2	2	2	2				2			
	A 5 P V2 CLAMSHELL INNER				0	0															
	A 18 P DUMMY ROD HYD . R					O															
	A 1 T V2 FAIRING AMBIENT				0	0	0														
	A 2 T V-2 CLAMSHELL AMB				0	0	0		0		0	0									
	A 3 T V2 CONDUIT				0	0	0														
	A 4 T V2 SERVO ELEC CON				0	0	o														
	A 6 T ROD PANEL AMBIENT				0	0															
	7 T DUMMY ROD INNER A				0																
	A 8 T DUMMY ROD INNER B				0																
	A 9 T DUMMY ROD OTARD NUT				0																•

THIS MATERIAL CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED! FYES WITHIN HE NEARING OF THE SPIONAGE LAWS, TITLE TO USEC SECTIONS 750 AND 754. THE TRANSMISSION OR REVELATION OF WHICH IN ANY MALMER TO AN UMANTHORIZ, 9 FERS 3 IS PROHIBITED BY LAW.

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A	16 T DUMMY ROU OUTER A		0								
A	17 T DUMMY ROD OUTER B		0								
A	19 1 V2 FAIRING AMBIENT 2				0		0	0			
A	20 T V-2 CLAMSHELL COMPNT				0		0	0			
A	21 T V-2 FAIRING COMPONET				O		0	0			
A	41 T MISSILE TK NR PB POD					Q	0		0	0	
A	42 T MISSILE TK NR PB POD					0	0		0	0	
A	43 T MISSILE TK NR PU POD					0	0		0	0	
A	44 T MISSILE TK NR PB POD					0	С		0	0	
A	45 T MISSILE TK NR PB POD					0	0		0	Ů	
A	46 T MISSILE TK NR ADF					0	O				
Д	47 T MISSILE TK NR ADF					0	0				
Å	48 T MISSILE TK NR ADF					0	0				
A	49 T MISSILE TK NR ADF					0	0				
A	51 T MISSILE TK NR AFSWC						0		0	0	
A	52 T MISSILE TK NR AFSWC						0		O	0	
A	53 T MISSILE TK NR AFSWC						0		0	0	
A	54 T MISSILE TK NR AFSWC						0		0	0	
A	55 T MISSILE TK NR AFSWC						0		0	0	
A	282 T LO2 FWD BLKHD Q1					0	0	0	0		
A	294 T LO2 FWD BLKHD Q3					0	0	0	0		
A	409 T BLACK CALOR GUAD 1	0		0	С						
A	412 T BLACK CALOR QUAD IV	0		0	0						
A	438 T 38 GM CALOR QUAD IV	0		0	0						
A	439 T 38 GM CALOR QUAD I	0		0	0						
A	440 T 19 3M CALO. QUAD IV	0		э	0						
A	443 T 19 GM CALOR QUAD I	0		ð	0						
A	446 T CBLEWAY FRG COMP AMB							С	û	υ	
A	452 T BI POD AMBIENT						0	0	0		
A	455 T B2 POD AMBIEN						0	0	0		
A	458 T AIG POD AMBIENT			0	0	0					
A	467 T 82 HAT SECTION INBRD			0	0	0					
A	476 T 82 HAT SECTION OTHER			0		0					
A	473 T HEAT SHILLD OUTER			0	0	0					
A	416 I HEAT SHIELD INNER			0	0	0					
A	479 T ADAPTER SECT AMBIENT							0	0	0	
A	488 T AMB F STG VLV Q3	0 0 0 0	0								

THIS MATERIAL CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPICIAGE LAWS, TITLE 18, U.S.C., SECTIONS 793 AND 794, THE TRANSMISSION OR REVELATION OF WHICH IN ANY MANKER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW

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A	638 T AFT SIDE A FRAME Q2	O	0	0	0	o	0	0	0	0	0	0	0
A	639 T AMB JET RAIL Q4	0	0	0	0	0							
A	640 T FWD SIDE A FRAME Q4	0	0	0	0	0							
A	641 T AMB F STG VLV Q1	0	0	0	0	0							
Α	642 T AMB NEAR B2 5G Q3	0	0		0	0							
A	645 T AMB FWD 81 Q4	0	0	0	0	0							
A	666 T ADAPT SKIN FWD										o	0	0
A	667 T ADAPT SKIN CTR										0	0	0
Α	668 T ADAPT SKIN AFT										0	0	0
A	671 T #3 FWD WRG+TBG FRG										0	0	c
A	674 T FWD WRG-TBG FRG										0	0	0
A	676 T V2 FRG FWD										0	0	o
A	677 T V2 FRG CTR										0	0	0
ı	678 T V2 FRG SIDE										0	٥	0
A	679 T V2 FRG AFT										0	0	c
A	682 T #1 AIG POD INSUL OUT							0	0	0			
A	663 T #1 AIG POD INSUL IN							0	0	0			
A	684 T #2 AIG POD INSUL OUT							0	0	o			
A	685 T #2 AIG POD INSUL IN							0	0	Ö			
A	686 T #3 AIG POD INSUL OUT							၁	0	0			
A	687 T #3 AIG POD INSUL IN							0	0	0			
A	688 T #4 AIG POD INSUL CUT							ŷ	Ö	υ			
A	689 T #4 AIG POD INSUL IN							0	0	6			
A	690 T #5 AIG POD INSUL OUT							0	0	0			
Α	691 T #5 AIG POD INSUL IN							c	0	0			
Á	698 T 81 AFT FRG INSUL OUT										0	0	0
A	699 T B1 AFT FRG INSUL IN										0	0	0
A	752 T LOZ TANK SKÍN STA516										0	0	0
A	753 T LO2 TANK SKIN STA575										o	0	U
A	754 1 LO2 TANK SKIN STA640										0	0	0
A											0		
A											0		
A				C) ()	c)					
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•	122 I HENC MIT BIE IS CHEUK							`	. `	-			

THIS MATERIAL CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNIVERSAL TO AN UNAUTHOR LIFE U.S. SECTIONS 793 AND 794. THE TRANSMISSION ON REVELLATION DEPICE IN ANY MARHER TO AN UNAUTHOR CONTROL OF THE CON

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E FLI	GHT	OBJ.	COMPOSIT	E 15	MAY	61	4	4	8	9 1	2 1	3 1	6 1	7 1	8 2	1 2	2 2	5 2	6 3	0 3	2 3	5 3	6 4	0	C	105
	A	978 1	r GE BOOM	ANT S	STRUT										•	0	0	ა								
	A	979	r GÉ 800M	ANT S	STRUT											0	0	0								
	F	771 1	LOX TK	HE INL	LET										0	0	0	0								
	F	773	LOX TK	ULG S1	TA 54	.0										0	0	0								
	F	775	T LOX TK	ULG S	TA 60	0										0	0	0								
	F	777	T LOX TK	ULG 5	TA 66	0										0	0	0								
	F	780	T LOX TK	ULG S	TA 72	10										o	0	0								
	F	783	T LOX TK	ULG 5	TA 78	10										0		0								
	F	786	T LOX TK	ULG S	TA 84	0										0		0								
	Ţ	534	T ANALOG	SIG C	ONVER	TER			0	0	0	0	0													
	I	535	T COMPUTE	R					0	0	0	0	o													
	ρ	671	T TH SECT	AMB (QUAD	4	0	0	0	0		0	0	0	0	0	0	0								
	T	2	T B1 T/C	REFER	JUNC	. T	0	0	0	0	0															
	T	3	T S T/C R	EFER .	JUNCT		0	0	0	0	o															
	Ţ	4	T ARMA T/	C REF	JUNC	:τ							0	0	0											
	T	103	T BOOSTER	T/C	REF				0	0	0	0	0	0												
	t	104	T POD 2 T	/C RE	F JUN	IC T										0	0	0								
	Ť	105	T POD 1 T	/C RE	F JUN	ICT									0	0	0	0								
	T	162	T V T/C R	EFER	JUNCT	r				Ç																
AE55	RQC BOO TUR	KET E TS TO E INT	ATE ABILI NGINE HEA PROTECT ERIOR FRO GAS ACCUM	T SHI BOOST M HEA	ELD A ER SI I AND	TRUC	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2		
	A	744	I THRUST	SECT	LITE	B2	0	o	0	0	0															
	A	409	T BLACK C	ALOR	DAUC	I			0				0	0												
	A	412	T BLACK (ALOR	QUAD	IV			0				0	0												
	A	438	T 38 GM C	ALOR	QUAD	IV			0				0	0												
	A	439	T 38 GM C	ALOR	DAUC	1			0				0	0												
	A	440	T 19 GM C	ALCR	QUAD	IV			٥				0	0												
	A	443	T 19 GM C	ALOR	QUAD	1			0				0	0												
	A	461	T V1 HEAT	5H1E	LD											0	0	0								
	A	464	T THRST S	TRUCT	URE S	SKIN							0	0	0											
	A	473	T HEAT SH	11£ ~	OUTER	₹							0	0	0											
	A	476	T HEAT SH	IELD	INNER	₹							0	Ç	0											
	A	638	T AFT SIC	EAF	RAME	Q2	0	0	0	0	0	0	0	0	Q	0	0	၁	0		0	0	0			

A 642 T AMB NEAR B2 1G Q3 0 0

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E 761	GHI	OBJ.	COMPOSITE	15 MAY C	• 1	.9	•	¢	7	12	10	10	.,	10	21 (• >	0 ,			,,,,	·
	A	445 T	AMB FWD B1	04		e	0	0	٥	0													,
			BI NACELLE			•	•		-			0	0	0									
			B2 NACELLE									0	0										
			B1 NACELLE									0	0	-									
			B2 MACELLE									0	0	0									
			B1 NACELLE									0	0	0									
			B2 NACELLE									0	0	_									
			TH SECT AM			G	0	o	0		0	0	٥		٥	٥	0	0	0	O	0	0	٥
	· Ţ		S T/C REF			•	Ĭ	0	·		Ĭ		·	•		•	•		•	•	·	Ť	
	Ţ		ARMA T/C R									c	۵	0									
			BOOSTER TA					o				_	0	·									
	1		POD 2 1/C		T			•				•	Ĭ		0	0	e						
			POD 1 T/C											0	_	0	0						
	•	403 I		JONC	•									·	•	•	•						
AE36	SEP/ SON INT	aratio Boost Erfere	TE ABILITY ON MECHANISH 'ER STRUCTUM INCE TO SUS' STEMS OPERA	M TO JETT RE WITHOU TAINER	I -	1	1	i	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2
	1	513 A	ACCEL XF1	DIRECT		o	0	0	c	0	0	0	0	0	0	0	· o	0		0	0	0	
	ĭ	514 A	ACCEL XF2	DIRECT		0	0	0	o	0	0	0	0	0	0	0	0	0		0	0	0	
	I	516 A	ACCELEROM	ETER YF1		Q	0	0	c	0	0	0	0	0	0	0	0	0		0	0	0	
	1	517 A	ACCELEROM	ETER ZF1		0	0	0	c	0	0	0	0	0	0	0	0	0		0	0	0	
	I	519 /	ACCELERON	ETER YF2		0	0	0	C	0	0	٥	0	0	0	0	0	0		o	0	0	
	1	\$20 /	A ACCELERON	ETER ZF2		0	0	0	•	0	0	C	0	0	0	0	٥	0		0	0	0	
	I	570	x STAGING S	1GNAL		0	0	0		0	0) 0	0	0	0	0	o	0	0	0	o	0
	н	143	D BSTR SEPE	RATION		d	0	c) ()	c	, ()										
	H	_	X CONAX VAL		ND	c	. 0	c	, () (,		c	0	0	0	0	0	0	0	0	0	0
	M	_	X B STG LAT				0) (0 0)												
	M		X B STG LAT			c	0	c) (0 0)												
	M		X B STG LAT			c	0). (5 0)												
	M		X B STG LAT							0 (
	5		D SUSTAINER							D () () () 0	0	0	o	o	0	0	o	0
	5		D SUSTAINER							0 (
	5	-	R ROLL RATE							0 (
	5		R PITCH RAT		16					0 (
	5		R YAW RATE							0 (
	_		A AXIAL ACC				•										·		0				o
	_																						

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E FL	IGHT OSJ. COMPOSITE 15 MAY 61	3	4	8	9	12	13	16	17	18 ;	21 2	22 2	25 7	26 3	30 3	12 3	15 3	16 4	•0
AÉ57	DEKOMSTRATE ABILITY OF RETARD- ING ROCKETS TO SEPARATE MAIN PROPELLANT TANK STRUCTURE FROM RE-ENTRY VEHICLE WITHOUT BUMP- ING RE-ENTRY VEHICLE.	2	2	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2
	I 513 A ACCEL XF1 DIRECT	0	0	0	0	0	0	0	0	0	0	0	0	0		٥	0	0	
	I 514 A ACCEL XF2 DIRECT	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	
	I 516 A ACCELEROMETER YF1	0	0	0	0	0	0	0	0	0	0	0	٥	С		0	0	0	
	I 517 A ACCELEROMETER ZF1	0	0	0	0	0	0	0	0	0	o	0	0	0		0	o	0	
	I 519 A ACCELEROMETER YF2	0	0	0	0	0	0	0	0	0	0	0	0	0		0	٥	0	
	1 520 A ACCELEROMETER ZF2	0	0	0	0	0	0	0	0	0	0	٥	0	٥		0	0	0	
	1 521 X VERN ENG COF SIG	0	0	0	0	0	0	0	0	o	0	0	0	0	٥	0	0	0	0
	P 548 X COMPLETE COF RELAY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	c	0	·o
	S 52 R ROLL RATE GYRO	0	0	0	э	0	0	0	0	0	o	0	0	0	0	0	0	9	0
	S 53 R PITCH RATE GYRO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	S 54 R YAW RATE GYRO	0	٥	0	C	¢	٥	0	0	0	0	0	0	0	0	0	0	Q	C
	5 248 X A/P PG SWITCH 17		0	o	0	O	0	0	0	0	0	0	0	0	0	0	٥	0	O
	5 248 X RELEASE NOSECONE	0																	
	U 101 A AXIAL ACCELERATION														0				0
	Y 1 X SEPARATION SIG	0	0	0		9	0			0	o	0	0	0	o	0	0	o	-
AE59	OBTAIN DATA ON VIBRATION LEVELS OF MGS COMPONENTS AND ENVIROMENT.	2	2	2					2										
	G 196 O PB-IP RADIAL								0										
	G 587 O POD WAVEGUIDE								o										
	G 595 O P8 WAVEGUIDE-RAD								Q										
	G 588 P WAVEGUIDE PRESSURS 1	0	0	0															
	G 589 P WAVEGUIDE PRESSURE 2	o	0	0															
	G 281 V RB REFLECT SET	ø	0	С															
AE60	OBTAIN DATA ON TANK-SECTION BENDING.		1																
	A 862 O BZ PUMP UNIT Y AXIS		0																
	A 863 C 82 PUMP UNIT Z AXIS		0																
	A 945 0 BZ GIMBAL BLOCK Y AX		ô																

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E FL	1 GHT	٠ز8٥	COMPOSI	ΙE	15	MAY	6:	3	4	8	9	12	ו יו	6 17	18	21	22	25	26	30	32 3	5 36	• ,
	A	946 0	B2 YAW	NCT	TIE	PT			0														
	5	52 R	ROLL RA	re g	YRO	S 1	G		0														
	\$	33 R	PITCH R	TE	GYR	10 S	1 G		U														
	5	54 R	YAW RAT	E GY	RO	5 16			0														
AE61	PER	FORMAN OVAL O	EFFECT OF CE RESULT F MONSTRI AND INSU	I I NG	FR	IOM	•								1		1						2
	A	282 T	LO2 FWD	BLK	CHD	01									0		c						
	A	294 T	LO2 FWD	BLK	HD	23									0		0						
	F	1 P	LOZ TAN	C HE	LIU	M									0		c						0
	F	3 P	FUEL TAI	W H	ŒLI	UM									0		0						o
	F	34 P	FUEL PR	:55	ORF	C D	P								0		0						
	F	65 P	LOX TK	IE L	.N @	OR	FC								0		Û						
	F	147 P	LOX PRE	s o	RFC	OP.									0		J						0
	F		FUEL PRI												0		0						
	F	246 P	B YANK I	IE B	ЮТТ	LES	HI								0		0						o
	F	17 T	FUEL PRI	\$5	ORF	C 1	N								0		0						
	F	97 T	LOZ TK	ILG	STA	78	7								0		0						
	F	146 T	LOX PRES	is o	RFC	IN									0		٥.						
	F	247 T	6 TANK	E 8	OTT	LES									0		0						0
	F	371 T	LOZ TK (ilg	STA	69	1								٥		0						
	F	374 T	LOZ TK I	LG	STA	80	7								0		0						
	F	**5 7	LOZ TK Y	LG	STA	52	7								o		٥						
	F	376 T	LOZ TK U	LG	STA	844	5								0		0						
	F	377 T	LOZ TK L	LG	STA	86	7								0		0						
	F	773 1	LOX TK L	LG	5TA	546	0								o		0						
	F	774 T	LOX TK L	LG	STA	570	0								0		Q						
		775 T	LOX TK L	L G	STA	60	0								0		9						
	F	776 T	LOX TX (L G	STA	63	9								0		o						
	F	277 Ţ	LOX TK I	ĻĢ	STA	66	0								c		٥						
	*	700 T	LOX TK	K.G	STA	72	0								0		0						
	¥	781 T	LOX TE L	l G	STA	740	0								Ü		Q						
	*	782 1	LOX TK L	K G	STA	76.	2								3		0						
	,ee	844 .T	FUEL TK	HΕ	\$ T A	42	5										0						
	*	845 T	FUEL TR	.sE	STA	93	,										0						
	F	844 T	FUEL TX	HE	STA	74	5										٥						

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FLIGHT OBJ. COMPOSITE 15 MAY 61 3 4 8 9 12 13 16 17 18 21 22 25 26 30 32 35 36 40

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PROPULSION SYSTEM

PE 51		.510N	A FOR ANALYSIS OF SYSTEM PERFORMANCE ITY.	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	I 51	13 A	ALCEL XF1 DIRECT	c	0	0	٥	o	0	0	0	0	0	0	0	o		0	٥	O	
	I 51	14 A	ACCEL XF2 DIRECT	0	0	0	0	0	0	0	0	0	o	0	0	ø		0	0	O	
	1 5	16 A	ACCEL YF1	٥	0	٥	٥	0	э	Ç	٥	o	0	0	0	o		0	0	0	
	1 5	17 A	ACCEL YF2	0	0	0	o	0	0	0	0	ن	٥	0	0	o		0	0	0	
	1 5	19 A	ACCEL ZF1	o	0	0	၁	0	o	0	0	0	0	၁	0	0		0	0	0	
	. 5.	20 A	ACCEL 2F2	0	0	٥	0	0	o	0	o	o	o	0	0	0		0	٥	o	
	P	6 P	S THRUST CHAMBER	0	0	0	0	0	0	0	0	0	0	o	0	o	o	0	0	0	0
	P	27 P	VERNIER FUEL TANK	0	0				G	0	0	o	0	0	٥	o		0	0	o	
	P.	28 P	V1 THRUST CHAMBER	0	0	0	0	o	0	o	o	0	0	0	0	0	o	С	0	0	0
	P.	29 P	V2 THRUST CHAMBER	o	0	0	0	0	0	0	O	0	0	0	٥	0	၁	0	0	o	0
	Ρ	30 P	VERNIER LOZ TANK	0	0			0	0	0	O	0	0	0	0	0		0	9	0	
	P	38 P	B2 FUEL PUMP DISCH	ก	0	0	0	o	¢	0	0	0	0	0	0	0	0	э	O	0	0
	P	39 🤉	81 FUEL PUMP DISCH	С	0	0	0	0	0	o	0	C	0	0	0	0	0	o	٥	0	0
	p	59 P	B2 THRUST CHAMBER	0	0	0	O	0	0	o	0	Э	0	၁	0	0	0	0	0	0	0
	P	60 P	B1 THRUSE CHAMBER	0	0	0	0	0	O	0	0	Э	Э	0	0	0	0	0	0	0	0
	Þ	91 P	B1 LO2 INJ MANIFOLD	0	0	0	0	0	O	0	0	9	0	O	0	0	0	0	¢	0	0
	P	92 P	BZ LOZ INJ MANIFOLD	0	0	O	0	0	0	0	0	0	0	0	0	0	0	C	0	o	0
	P 1	85 P	B1 TURBOPUMP GEARBOX	o	0		0														
	P 1	88 9	82 TURBOPUMP GEARBOX	0	0		0														
	P 2	79 P	BZ LO PR LUB CIL MAN	0	0	0	0	0	0)	C	0	0	7	:	O	0	0	0	0	٥
	Р 3	30 P	S FUEL PUMP DISCH	0	Э	0	0	Q	0	Э	J	Ö	0	0	0	0	Э	٦	0	0	0
	ρ 3	37 P	SGG LOZ INJ MAM	0	o	0	3	0	O	Э	0	0	٥	Э	٥	0	Q	Ü	Ç	٥	C
	و ۾	41 F	S LUBE OIL MANIFOLD	0	O	0	0	Э	0	Ç	Э	0	Ů)	Ö	v	Ą	0	ହ	Q.	Ç-
	P 3	51 P	S LOZ INJ MANIFOLD	0	Q	ð	Û	3	i	Э	C.	ڼ	Ü	Ų	0	Э	Ç	C	Ç	ð	J
	₽ 4	73 P	81 LO PR LUB OIL MAN	٥	0	٥	٥	ن	C	0	٥	0	Q	0	-0	ु	Ų	9	Ð.	٥	Ō
	P 5	71.7	TH SECT AMB QUAD .	9	э	0	3		0	٥	G	0	٥	ं	ð	٠,٦	٤	c	٥	3	٥
	o 7	'ଚ୍ଚୁ ଅ	SGG COMBUSTOR	0	3	ی	c	9	Ĵ		-0	٥	Ş	٥	9	c	٥	٥		Ç	c
	ې د	13 7	dl GAS GEN COMBUSTOR	٥	0	0	٥	2	0	Ģ	0	a	ō	÷	0	0	0	ť	3	e	e
	p 7	14 1	BZ GAS GEN COMBUSTOR	٥	3	٥	Ş	О	J	٥	٥	Ş	Ş	0	0	O	ē	٥	ű	Ü	0
	₹ :	(J: A	AXIAL ACCELERATION														2				į.
	x 91	i	PRESSURE IS AUTITUDE		Ç	÷	3	Ş	:	ō	,5	U	w	٥	Ų	3	Ç	ń	J	_	ę

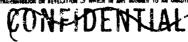
SECTION 9

CONFIDENTIAL

15 MAY 1961

E FL	IGHT OBJ.	COMPOSITE	15 MAY	61	3	4	8	9	12	13	15	17	18	21	22 2	25	26	30	32	35	36	40
			#B (ND		_																	
PE54	OBTAIN DAT SUSTA'NER THRUST RIS SUSTAINER, THRUST DEC CHARACTERI	ENGINE DIF E RATES AN AND VERNI AY RATES A	FERENTI D 9GOST ER ENGI	ER.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	I 513 A	ACCEL XF1	DIRECT		C	0	0	0	o	0	0	G	0	0	0	0	٥		0	o	0	
	I 514 A	ACCEL XF2	DIRECT		0	0	O	0	0	0	0	0	o	0	0	0	0		0	0	0	
	I 516 A	ACCELEROME	TER YF	L	0	0	0	٥	0	o	0	0	0	0	٥	0	٥		0	0	0	
	I 517 A	ACCELEROME	TER ZF	l	0	0	0	o	0	0	0	0	0	0	0	0	0		0	0	Q	
	I 519 A	ACCELEROME	TER YF	2	0	0	0	0	0	0	0	0	0	0	0	Q	0		0	0	ø	
	1 520 A	ACCELEROME	TER ZF	2	0	0	0	o	o	Q	0	0	o	0	0	0	٥		0	٥	0	
	M 75 A	MSL AXIAL	ACCEL	FINE							0	٥	0	۵	0	0	0		0	0	o	
	P 83 B	B2 PUMP SE	PEED		0	0	0	٥	0	0	0	0	0	0	э	0	0	0	0	Q	Q	0
	P 84 B	B1 PUMP SE	PEED		0	0	0	0	0	0	0	0	0	٥	0	0	٥	٥	0	0	0	0
	P 349 B	S PUMP SPE	EED		0	9	0	0	0	0	0	0	C	0	0	0	0	o	0	0	0	0
	P 6 P	S +HRUST	CHAMBER		0	0	0	0	0	0	٥	0	0	O	0	Q	0	Q	0	0	0	0
	P 28 P	VI THRUST	CHAMBE	R	0	0	C	0	0	0	၁	0	O	Q	0	0	0	0	0	0	0	0
	P 29 P	V2 THRUST	CHAMBE	R	0	0	0	0	0	O	0	0	0	0	0	0	c	0	o	0	0	0
	P 38 P	32 FUEL PO	JMP DIS	СН	0	0	0	0	0	0	0	0	0	0	0	· o	0	0	0	0	0	С
	P 39 P	81 FUEL P	JMP DIS	СН	0	0	0	0	J	0	v	٥	0	o	0	0	0	0	0	0	0	٥
	P 59 P	B2 THRUST	CHAMBE	R .	0	0	0	0	0	0	0	0	0	0	0	0	٥	0	0	o	0	0
	P 50 P	81 THRUST	CHAMBE	R	٥	0	0	0	O	0	0	0	0	0	0	0	0	0	0	0	0	0
	P 91 P	B1 L02 IN	J MANIF	OLD	0	0	0	0	0	0	0	0	0	0	0	0	O	0	0	0	0	0
	P 92 P	82 LO2 IN	J MANIF	OFD	0	0	0	0	0	0	0	0	0	o	O	0	0	0	0	0	0	0
	P 330 P	S FUEL PU	MP DISC	н	0	o	0	0	0	0	0	0	0	0	٥	0	O	0	0	0	0	٥
	9 351 P	S LO2 1NJ	MANIFO	LD	0	0	0	Ü	0	o	0	0	0	0	0	0	0	0	0	0	c	0
	P 709 T	SGG COMBU	STOR		O	. ૦	0	0	0	Ç	0	C	0	0	0	0	0	0	0	0	, o	o
	P 713 T	B1 GAS GE	N COMBU	STOR	0	0	0	0	o	c	0) C	0	0	0	0	0	0	0	0	0	0
	P 714 T	B2 GAS GE	N COMBU	STOR	0	0	0	0	o	0	0	C	0	0	0	0	0	0	0	0	0	0
	€ 1161 X	TCC START	SWITCH	I	0	ũ	C	0	0	C) (0	0	0	c	0	()	9 0	Ģ	Q	C	0
	⊬ 347 X	S CUTOFF	RELAY		0	0	0	O	0	C) () C	0	0	0	C	0) (0	0	0	9
	P 547 X	B1 CUTOFF	RELAY		0	0	0	0	0	C) C) ~	٥ ،	0	0	0	0	0	0	0	0	o
	P 548 X	COMPLETE	COF REL	AY	0	0	0	0	0	C) () (0	0	0	0	0) (0	0	0	0
	£ 1549 X	IGNITION	START		ſ	0	0	0	Ú	C	0) (0	0	0	0	0) C	0	0	0	0
	U 101 A	AXIAL ACC	ELERATI	ON														¢)			0
FE.56	POMP NPSH	SUSTAINER DURING AN FOLLOWING	o IM-		2	2	1	1	1	2	? 2	? 2	? 2	2	2	2	2	: Z	2	2	2	2
	P ३६३ घ	S PEME SP	E E O		_	c)	0	0	0				١ ،			^			. ^	0		

THIS MATERIAL CONTAINS IMPORMATION AFFECTION THE MATIONAL DEFENSE OF THE UNITED STATES INTOINITHE MEANING OF THE EMPORMAGE LAWS, TYTLE 19, 4-5-0. CECTIONS 783 AND 791, THE TRESSMISSION OR SEVELATION OF WHICH IN ANY MARKER TO AN UNMUTRICALZED PERSON IS PROVIDED BY LIMI



SECTION 9

13 MAY 1981

E FL	1 GHT	08).	. (COMP	0517 E	. 1	S MAY	61	3	4	8	9	12	13	16	17	18	21	22 :	25	26	30	32	35	36	46	01:
	P	6	P.	S TH	RUST	CHA	AMBER		0	0	С	0	O	c	ა	э	0	0	٥	0	0	0	o	0	0	ø	
	P				2 PUM				0	0	0	o	5	0	С	2	9	9	2	0	0	0	٥	0	0	٥	
	-								0	0	0	0	0	0					_	-	-	_	o	-	()	0	
PE57	SYS ICS COM	TEM :	STA DET ION	RTIN ERMI CUT		IRA BY	CTERIST THE ROU		1																		
	P	1439	0	S NA	A RCC	: A:	CCEL		C																		
	P	1452	С	B1 N	IAA RC	c	ACCEL		0																		
	P	1453	0	B2 N	IAA RO	c	ACCEL		0																		
	0	1437	W	S RC	C BIN	NAR	Y COUNT	ER	0																		
	P	1454	₩	81 F	CC BI	ENA	RY COUN	ITR	o																		
	Ρ	1455	W	82 F	CC B	i N 4	RY COUN	TR	0																		
	þ	1152	X	81 F	ROUGH	co	48 COF		0																		
	P	1193	x	82 F	ROUGH	co	MB COF		0																		
	₽	1438	x	5 R	DUGH (СОМ	B COF		0																		
PE60	PRO	PELL	ANT	FE		: - F	515 (: N 22 20		1	1	1	ı	1	2	2	2	2	2	2	2	2	2	2	2	2	2	
	P	38	P	B2 !	FUEL	ਿਹਮ	e Dick	4	0	Ç	0	0	0	O	o	0	С	0	0	0	0	0	O	0	0	c)
	p	39	D	B1 /	FUEL F	FUM	P DISCH	1	٠,	ζ.	O	0	0	0	r	0	0	0	0	0	0	0	Ç	0	Q	¢	•
	P	56	P	S L	DZ PUN	мр	INLET		ر	U	С	0	0	O	0	0	ວ	Q	0	0	0	c	0	0	0	¢)
	Ρ	91	F	81 (_02 1	LI	MANIFOL	ָ ח	э	0	0	0	0	0	0	С	¢	O	С	0	0	O	0	0	Q	C)
	₽	92	P	82 (LO2 11	LN	MAN1FOL	-0	0	0	0	0	C	0	0	0	0	0	ა	0	0	0	0	0	O	5	;
	ĺЪ	330	Р	\$ FI	JEL PI	UMP	DISCH		0	0	0	0	0	ō	0	0	0	0	0	0	0	0	Ú	o	0	C)
	Ö	337	P	SGG	L02	INJ	MAN		0	0	c	0	0	o	0	0	٥	0	0	0	Q	O	0	0	c	٠)
	5	351	P	5 L	02 IM	J M	ANIFOL	>	0	0	0	0	0	0	0	0	0	o	C	0	0	0	0	0	0	c)
	ţ	530	ı i	S L	02 PUI	MP	INLET		0	0	0	0	0	0	O	0	0	Ō	0	0	0	0	0	0	Q	C)
	υ	3(þ	LOZ	TANK	HE	AD		0	0	0	0	0	0	0	0	0	Ù	0	0	0	Q	0	0	٥	•)
	U	81	. 5	FUE	L TAN	K F	IE AD		0	0	0	0	Q	0	0	0	0	c	0	0	0	0	0	0	0	• ()
PESI	54 2.4 5.0	aG K ESSUR	√) (1 (1) (1 - A)	ALVE SURG	DOF5	NO I CH	RE OF LE OT CAUS! I EXCEE! IS OF TI	F. D	1																		
	þ	798	5 A	t . 12	ME	(A)	CIAL AC	CEL	0																		
	b	799	A	1.62	LINE	L	ACCE	L	0				0														
	Р	56	, P	S L	02 PU	MP	INLET		э				o														

THIS MATERIAL CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENDE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPONANC LAWS TITLE

CONFLIDENTIAL

U 1107 C PU SV AMP OUT

CONFIDENTIAL

012

SECTION 9

15 MAY 1961

E FLISHT OBJ. COMPOSITE 15 MAY 61 3 4 8 9 12 13 16 17 18 21 22 25 26 30 32 35 36 40 PROPELLANT UTILIZ SYS UEST OBTAIN DATA FOR ANALYSIS OF 1 1 1 1 1 1 1 1 1 1 1 CONVAIR PU SYSTEM PERFORMANCE REPEATABILITY. H 414 P PU VLV CL3-SERVO o 0 0 528 D S MAIN FUEL VALVE 0 0 0 0 0 P 529 D S MAIN LOZ VALVE ٥ Ð U 107 C PU SV AMP OUT O U 1107 C PU SV AMP OUT ٥ 80 P LOZ TANK HEAD 0 81 P FUEL TANK HEAD 0 0 91 V ERROR RATIO DEMOD OF 0 0 O 000000000 U 1091 V ERROR RATIO DEMOD OP U 409 V PU VLV COMMAND VOLT 1 1 1 1 1 1 UE53 OBTAIN DATA FOR ANALYSIS OF ACOUSTICA PU SYSTEM PERFOR-MANCE REPEATABILITY. 0 0 0 80 P LOZ TANK HEAD 0 0 81 P FUEL TANK HEAD 112 V ACOUSTIC COUNTER OTP ٥ ٥ 9 113 V ACQUSTICA VLV POS FB 0 U 132 X AA STA COUNTER OTP U 133 X AA SCHMITT TRIGGER Ü 0 134 X AA TIME SHARD OSC OP 000000 U 135 X AA SENSORS SIG 1 1 1 1 UE54 OBTAIN DATA ON PU VALVE OPERATION. 0 0 0 0 U 107 C PU SV AMP OUT

> THIS BATERIAL CONTAINS INFORMATION AFFOCINGS THE NATIONAL REFERME OF THE MATTER STATES WITHIN THE MEANING OF THE EXPONENCE CARR, TYPES 18, U.S.C., SECTIONS THE NOT THE TRANSMISSION OR REVELLATION OF THICK! IS ANY MANNER TO AN IMMITTIONIZED PERSON IS PROMISTED BY LAW.

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CONEHDENTIAL

REPORT NO. AZC-27-059

SECTION 9

013

15 MAY 1961

E FL	I GHT	.180	COMPOSITE	15 MAY	61	3	•	8	9	12	13	16	17	18	21	22	25	26	30	32	35	36	40
		AUTO	PILOT	٠																			
SE51	AUT		TA FOR ANAL PERFORMANC			2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	I	528 V	YAW STEERI	NG SIG		0	o	0	0	٥	0	0	0	0	0	0	0	o	o	0	o	0	c
	I	529 V	ROLL RESOL	VER SI	5	0	0	0	0	0	0	0	0	0	0	0	0	O	0	0	0	٥	. (
	i	530 V	PITCH RESC	LVER S	I G	0	0	0	0	0	0	0	0	0	0	O	0	ò	0	0	0	0	1
	1	580 V	AZM RESOLV	ER SIG		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	(
	1	521 ×	VERN ENGI	E COF	\$1G	0	9	0	0	0	0	0	0	0	Q	0	0	0	0	0	0	0	(
	I	522 X	S ENGINE	OF SIG		0	0	0	0	0	0	0	O	0	0	0	0	0	0	0	0	0	Ì
	ı	523 X	SEV COF RE	LAYS		9	C	0	0	0	0	0	0	0	0	0	0	0		0	^	0	
	1	570 X	STAGING S	IGNAL		0	0	0	0	٥	0	0	0	٥	0	0	0	0	0	0	0	0	•
	M	32 X	CONAX VALV	E COMM	AND								0	0	0	G	С	0	0	0	0	0	(
	F	347 X	S CUTOFF	RELAY		0	0	0	0	0	0	0	0	0	0	0	o	0	0	0	0	0	(
	P	547)	B1 CUYOFF	RELAY		0	0	0	0	0	0	0	0	0	0	0	0	٥	0	0	0	0	1
	P	548 >	COMPLETE (COF REL	AY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	5	61 (ROLL DISP	L GYRO	SIG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	S	62 (PITCH DIS	PL GYRO	\$1G	0	0	0	ð	0	0	0	0	0	0	0	0	0	o	0	0	0	
	5	63 (YAW DISPL	GYRO S	16	0	0	0	0	0	0	٥	O	0	0	0	0	0	0	0	0	0	
	S	203 (B1 PITCH	ROLL		0	0	0	0	۵	0	0	0	0	0	0	0	0	C	0	0	0	
	S	204	D 82 PITCH	RCLL		0	0	0	0	0	0	0	0	0	0	^	Ü	0	• •) (0	0	
	S	205	D B1 YAW			0	0	0	0	0	0	0	0	G	0	0	0	0	• 0) (0	0	
	S	206	D B2 YAV			0	0	0	0	0	0	0	0	0	0	0	0	C) C	0	0	
	5		D V1 PITCH			0		0	0	0		0		-									
	S		D V2 PITCH			0		0	C				_			_							
	5		D VI YAW RO			0			0			_					_		-				
	S		D V2 YAW RO			.0			_	_	·	-					_				•	-	
			D SUSTAINER			•	_	_		_	_	_	-	_			Ī	_			-)
		_	D SUSTAINER																				
	s ,	-	R ROLL RATE									•											
	<u>ن</u> د	_	R PITCH RATE																		9 6		
	S		R YAW RATE X RELEASE P					U	U	, (, 0	. (, (, (, (, (, (, (, (؛ ر	• (, (•
			X AIT PG SE			0		^	^		٠ ،	, ,	, ,	, ,	, ,		, ,	, ,	, ,	n (ט נ	, ,	,
			X BOOSTER		r		U	J	J		, ,										0 (
	3	313	Y DOCOTER (`	. (• •	. (. (, (·		•	•	•

THE MATERIAL CONTAINS INFORMATION AFFECTIVE THE MATIONAL BEFEME OF THE UNITED STATES WITHIN THE MEASURE OF THE EMPORMAN LANK, TITLE 15, U.S.C., SECTIONS 725 AND 794, THE TRANSMISSION OF ANY THE TRANSMISSION OF WINNERS IN MATERIAL AND UNMATHDRIZED PERSON IS PROMINETED BY LAW.

S 374 X SUSTAINER CUTOFF

CONFIDENTIAL

CONFIDENTIAL

SECTION 9

15 MAY 1961

E FL	1 GMT	097•	COMPOSITE	15 MAY 61	3	•	,	9	12	13	. 61	1 /	T.	3 1	24	27 (4	90	34 .	,,	30	•0	0,	4 *
	5	376 >	VERNIER CU	TOFF								0	0	0	0	0	0		C	0	0			
	5	379)	FIRE RETRO	ROCKETS								0	0	0	0	0	0		o	0	0			
	5	391)	THOR RETRO	ROCKET CMD									0					0		0	0	0		
SE54			E ABILITY OF AIN STABILIT		1	1	1	1	1	1	2	2	2	2	2	2	2	2	2					
			NCLUDE ANTI FECTIVENESS																					
	I	329 V	ROLL RESOL	VER SIG	0	0	0	0	0	0	o	0	0	0	٥	0	0	0	0					
	1	530 V	PITCH RESO	LVER SIG	٥	0	G	0	0	0	0	0	0	C	0	0	0	0	O					
	ı	380 V	AZM RESOLV	ER SIG	٥	Q	0	0	0	e	٥	0	0	0	0	٥	0	0	0					
	5	61 0	ROLL DISPL	GYRO SIG	0	0	0	0	0	0	0	0	0	0	0	0	o	0	0					
	s	62 [PITCH DISP	L GYRO SIG	0	0	0	0	0	0	o	0	٥	0	0	0	0	C	0					
	s	63 (YAW DISPL	GYRO SIG	0	0	0	0	Q	0	0	0	0	C	e	0	0	0	0					
	5	203 (B1 PITCH R	OLL	C	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
	s	204 (B2 PITCH R	OLL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
	5	205 (B1 YAW		0	0	0	0	n	0	0	0	0	0	0	Ç	0	0	0					
	5	206	B2 YAW		0	0	0	0	0	o	0	o	٥	0	0	כ	0	0	٥					
	S	222 (V1 PITCH		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
	s	223 (V2 PITCH		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
	\$	233	VI YAW ROL	L	0	0	0	0	0	C	0	0	0	0	0	С	э	9	0					
	5	234	V2 YAW ROL	L	0	0	0	0	0	Ò	0	0	0	0	0	0	0	0	0					
	\$	256	SUSTAINER	YAW	0	0	o		0	0	0	0	0	0	0	0	0	0	0					
	5	257	SUSTAINER	PITCH	o	0	O	0	0	0	0	0	0	0	0	0	0	0	O					
	\$	52 1	R ROLL RATE	GYRO SIG	0	0	0	0	0	0	0	0	0	0	0	0	0	o	C					
	5	53 1	R PITCH RATE	GYRO SIG	õ	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
	S	54 i	R YAW RATE G	YRO SIG	٥	0	O	0	0	0	0	0	0	0	0	0	0	0	0					
\$E56	TO		E ABILITY OF TE PROGRAMME		1.	1	1	1	1	1	2	2	2	2	2	2	2	2	2					
	1	529	ROLL RESOL	VER SIG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
	ı	530	V PITCH RESC	OLVER SIG	0	0	0	0	0	ij	0	0	0	o	0	0	0	0	0					
	I	580	V AZM RESOLV	ER SIG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
	5	61	D ROLL DISPL	. GYRO SIG	0	0	0	0	С	0	0	0	0	О	٠	o	0	0	0					
	S	62	D PITCH DISE	L GYRO SIG	0	0	0	0	, o	0	0	0	0	(·	,	0	0	0	0					
	S	63	D YAW DISPL	GYRO SIG	0	0	0	0	0	0	0	0	0	C	J	0	o	o	0					
	5	203	D B1 PITCH F	ROLL	0	0	0	0	0	L	0	0	ð	O	J	0	Q	0	o					
	S	204	D B2 PITCH F	ROLL	0	o	0	0	0	o	0	0	0	0	0	o	0	0	0					
	S	205	D B1 AM		0	0	0	0	Q	0	0	0	С	0	0	0	٥	٥	0					
	5	206	D 32 YAW		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					

THIS MATERIAL CONTAINS IMPORTANT INFO MATERIAL DEPOSIT OF THE MATERIAL STREET STREET AND THE SEPONDARY LIMIT, TITLE 18, M.S.C., SECTIONS 750 AND 750, THE TRANSMISSION OF SEPONDARY OF THE SECTION IS PROMISED BY LIMIT.

CONFIDENCE AND THE SECTION OF THE PROMISED OF THE SECTION

REPORT NO. AZC-27-059

SECTION 9

15 MAY 1961

E FLI	GHT	OBJ.	COMPOSITE	15 MAY 6	51	3	4	8	9	12	13	16	17	18	21	22	25	26	30	32	35	36	40	0	15
	S	222 D	V1 PITCH			0	0	С	0	J	0	0	0	0	0	0	0	0	0	0					
	S	223 D	V2 PITCH			0	0	0	0	Q	0	0	0	G	0	0	0	0	0	0					
	5	233 D	V1 YAW ROL	L		0	0	0	Ç	0	0	0	0	0	0	0	0	0	0	0					
	5	234 D	V2 YAW ROL	L		0	0	0	0	0	0	O	0	0	0	0	0	0	0	0					
	5	256 D	SUSTAINER	YAW		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
	S	257 D	SUSTAINER	PITCH		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
	5	52 R	ROLL RATE	GYRO SIG		0	С	0	0	0	0	0	0	0	0	0	0	С	Э	0					
	S	53 R	PITCH RATE	GYRO SI	Ģ	0	0	О	0	0	Q	0	0	0	0	0	0	0	0	0					
	5	54 R	YAW RATE G	YRO SIG		0	o	0	0	0	0	0	0	0	0	0	0	0	0	0					
SE58	TO ING MAN	EXECUT COMMA	ABILITY OF E DISCRETE NDS /INCLUD FROM MISSI SET»	AND STEE		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					
	ı	528 V	YAW STEERI	NG SIG		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
	1	529 V	ROLL RESOL	VER SIG		0	0	o	0	0	0	0	0	0	o	0	0	0	0	G					
	ī		PITCH RESC		,	0	0	0	0	0	0	o	0	0	0	0	0	0	0	0					
	I	580 V	AZM RESOLV	ER SIG		0	0	0	0	0	0	o	0	0	0	0	0	0	0	٥					
	I	521 X	VERN ENGIN	E COF SI	G	0	0	0	0	0	0	0	0	0	0	o	0	0	0	0					
	I	522 X	S ENGINE C	OF SIG		٥	0	0	0	0	0	0	٥	0	0	o	0	0	0	٥					
	1	523 X	S&V COF RE	LAYS		0	0	0	0	0	0	0	0	0	0	0	0	0		٥					
	ı	570 x	STAGING SI	GNAL		v	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
	м	143 0	BOOSTER SE	PARATION	l	0	0	0	0		0	0													
	М	32 >	COMAX VALV	E COMMAN	iD								0	0	0	0	0	0	0	0					
	P	347 >	S CUTOFF F	RELAY		0	0	o	0	O	0	0	0	0	0	0	0	0	0	o					
	Р	547 >	B1 CUTOFF	RELAY		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
	P	548	COMPLETE C	OF RELAY	,	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
	s	61 (ROLL DISPL	_ GYRO SI	G	0	0	0	0	0	0	0	0	0	0	C	0	0	0	0					
	5	62 (PITCH DIS	PL GYRO S	IG	0	0	0	0	0	0	0	0	0	0	0	0	0	Q	0					
	s	63 (YAW DISPL	GYRU SIG	•	0	0	0	0	0	0	0	0	0	0	0	0	0	0	o					
	s	203 (B1 PITCH I	ROLL		0	0	o	0	0	0	0	0	0	0	0	0	0	0	0					
	s	204 (B2 PITCH	ROLL		0	0	o	٥	0	0	0	o	0	0	0	0	0	0	0					
	5	203 (B1 YAW			0	0	0	0	0	o	0	0	0	0	0	0	0	0	0					
	s	206 (B2 YAW			o	Ģ	0	С	o	0	0	U	O	0	0	0	0	0	0	1				
	s	222 (V1 PITCH			0	0	0	0	0	0	0	0	0	0	·	0	0	c	0	1				
	5	223	D V2 PITCH			0	0	0	0	0	0	0	0	0	0) (0	C	٥	0)				
	S	233 (VI YAW RO	LL		0	0	0	0	0	Ò	0	0	0	0	· c) 0	0	0	٥)				

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Ē FLI	GHT	OBJ•	COMPOSITE	15 MA'	61	3	4	8	9	12	13	16	17	18	21	22	25	26	30	32	35	36	40	01	16
	s	234 D	V2 YAW ROLI	_		Q	0	0	0	0	J	ر	,	o	0	ō	o	a	o	0					
	5	256 D	SUSTAINER	YAW			0	0	0	0	o	0	0	0	0	ø	0	0	0	0					
	Ś	257 D	SUSTAINER	PITCH		Q	Ü	o	0	0	0	0	0	0	0	0	0	0	0	0					
	5	52 R	ROLL RATE	GYRO SIG	,	0	0	J	0	0	0	0	0	0	0	0	0	O	0	0					
	s	53 R	PITCH PATE	GYRO SE	G	0	0	0	o	O	0	0	0	o	0	0	o	0	o	0					
	5	54 R	YAW RATE G	YRO SIG		0	ð	0	0	0	0	0	O	0	0	0	0	0	0	0					
	s	248 X	RELEASE PA	YLOAD		0																			
	5	248 X	A/P PG SWI	TCH 17			o	0	0	0	0	0	0	0	0	o	0	0	0	o					
	s	373 X	BOOSTER CU	TOFF									0	0	0	0	٥	0		0					
	S	374 X	SUSTAINER	CUTOFF									0	0	,"3	0	0	0		0					
	\$	376 X	VERNIER CU	TOFF									0	0	0	0	0	0		0					
	S	379 X	FIRE RETRO	ROCKETS									0	0	0	0	C	0		0					
	5	391 X	THOR RETRO	ROCKET	CMD									0					o						
SE60	PRO ROT AND RAT	DUCTION DISPL	PERFORMANC N MODEL OF DETECTORS C ACEMENT GYR GIMBAL TOR Y	SPIN MO ON RATE OS AND	TOR																		1		
	5	61 0	ROLL DISPL	. GYRO S	16																		0		
	S	62 0	PATCH DASK	L GYRO	SIG																		0		
	S	63 0	YAW DISPL	GYRO SI	G																		0		
	5	52 F	ROLL RATE	GYRO SI	G																		0		
	5	53 F	PITCH RATE	GYRO S	1 G																		0		
	\$	54 R	YAW RATE C	SYRO SIG																			0		
SE61	ACC OPE SP/	ELERO	ATA ON BACK- METER SYSTEM P IN SUPPORT HICLE BOOST! /•	4 /FLOWN 1 OF ATL	ł						3	3	ı		3										
	\$	385 1	ACCEL 400	CYCLE C	ONT						0	C)		0	•									
	5	359	C BOOSTER 5	taging b	1/ 6						0	•	•		C)									
SE62	DR	FAIN DE IFT UP	ATA ON MISS TO 100 FT	ILE LATE AT VERTI	RAL ICAL			3	2	? 2	2	! ;	2	2	7	? 2	! 2	? 2	2	? 2	. 2	. 2	: 2		
	×	0000	X CAMERA CO	VERAGE				0	(0	, () (0) C	• •	0) () () () (• 0		0	1	

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15 1961

E FLIGHT OBJ. COMPOSITE 15 MAY 61 3 4 8 9 12 13 16 17 18 21 22 25 26 30 32 35 36 40 017

GUIDANCE

SE63			GROSS PERF UIDANCE SE	ORMANCE OF	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	I	530 V	PITCH RES	OLVER SIG	0	0	0	0	0	0	0	0	0	0	0	0	0	0	G	0	0	0
	1	580 V	AZM RESOL	VER SIG	0	0	0	0	0	၁	0	0	0	0	0	0	0	0	0	0	0	0
	I	521 X	VERN ENGI	INE COF SIG	0	٥	0	0	0	0	0	0	v	0	٥	0	0	0	0	0	0	0
	1	522 X	S ENGINE	COF SIG	0	0	0	0	0	o	0	o	0	0	0	0	0	0	0	0	0	0
	I	523 X	SEV COF R	RELAYS	0	o	0	0	0	0	0	0	0	0	0	0	0		0	0	0	
	1	525 X	PRE-ARM S	SIGNAL 1	0	0	0	0	o	0	C	0	0	0	0	0	0		0	0	٥	
	I	526 X	PRE-ARM S	SIGNAL 2	0	0	0	Ò	0	0	0	0	0	0	0	0	0		0	0	0	
	1	527 X	PRE-ARM F	RELAY CLOS	0	G	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	I	570 X	STAGING S	5 I GNAL	0	0	0	0	0	0	0	Ç	0	٥	0	0	0	0	0	0	0	0

PNEUMATIC SYSTEM

F 290 T S CTL HE BOTTLES

FE51	PNE	AIN DATA FOR ANALYSIS OF UMATIC SYSTEM PERFORMANCE EATABILITY•	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
	•	1 P LOZ TANK HELIUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	F	3 P FUEL TANK HELIUM	0	0	0	0	0	0	0	0	0	0	0	٥	0	ô	0	0	0	0
	F	34 P FUEL PRESS ORFC OP			0															
	F	65 P LO2 TK HE LIN @ ORI	FC 0	0	0						0	0	0	0						
	۶	114 P LO2 PRESS REG INLE	T	0	0		0													
	F	195 P S CTL HE BTL DISCH	٥	0	0	0	0	0	0	0	o	0	0	0	0	0	0	0	o	0
	F	147 P LO2 PRESS ORFC DP			0						0	0	0	0						
	F	212 P FUEL PRESS ORIFIC	IN		0															
	F	246 P B TANK HE BOTTLES	ні 0	0	0	٥	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	F	260 P B TARK HE BOTTLES	LO 0		0															
	F	17 T FUEL PRESS ORIFIC	IN		o															
	F	115 T LC? PRESS REG INLE	T 0	0	0	0	0	0	ø	0	0	0	0	0	٥	٥	0	0	٥	0
	F	146 T LOZ FRESS ORFC IN	0	0	0						Ó	0	0	0						
	F	247 T B TANK HE BOTTLES	0	0	0	0	0	0	0	0	0	0	0	0	0	٥	0	0	0	0

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E FL	IGHT OBJ. COMPOSITE 15 MAY 61	3	4	8	9	12	13	16	17	18	21	22	25	26	30	32	35	36	40	
FE53	DETERMINE EFFICIENCY OF NEW BOOSTER-STAGE HEAT EXCHAMGER IN PROVIDING EXPANDED HELIUM FOR MAIN PROPELLANT TANK PRESSUR! ZATION.		1	1	1	1	2 2	2	2 2	2 2	2 2	2 2	2 2	2	2	2	2	2	2	
	F 246 P B TANK HE BOTTLES HI	٥	٥	٥	٥	٥	0	٥	٥	٥	0	o	0	٥	٥	٥	٥	0	٥	
	F 260 P B TK HE BOTTLES LO		0	0		•	•	•	-		-		_		_		Ī	-	-	
	F 115 T LOZ PRESS REG INLET	_	-		0	٥	٥	٥	٥	0	٥	0	٥	٥	0	0	n	٥	0	
	F 247 T B TANK HE BOTTLES	_	٥												0				-	
	r 247 i b i kink hit bolitets	•	Ŭ	·	Ŭ	Ŭ	Ŭ	Ŭ	Ŭ	Ŭ	·	•	Ŭ	•	·	Ū	Ū	·	Ů	
FE54	DETERMINE ABILITY OF PNEUMATIC PRESSURE REGULATORS TO MAIN- TAIN NOMINAL MAIN PROPELLANY TANK PRESSURES.	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	
	F 1 P LO2 TANK HELIUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	F 3 P FUEL TANK HELIUM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	′,	0	0	
	F 65 P LO2 TK HE LIN . ORFC	0	0	o						0	0	0	0							
	F 114 P LO2 PRESS REG INLET		0	э		0														
	F 212 P FUEL PRESS ORIFIC IN			0																
FE56	EVALUATE TOTAL QUANTITY OF MAIN PROPELLANT TANK PRESSURIZ ATION HELIUM USED AND QUANTITY USED BY EACH TANK DURING BOOSTER OPERATION.			i																
	F 34 P FUEL PRESS ORIFIC DP			0																
	F 65 P LOZ TK HE LIN # ORFC			0																
	F 147 P LO2 PRESS ORFC DP			0																
	5 212 P FUEL PRESS ORIFIC IN			0																
	F 17 T FUEL PRESS ORIFIC IN			0																
	F 146 T LO2 PRESS ORFC IN			0																
FE57	DETERMINE TOTAL QUANTITY AND USAGE RATES OF MAIN PROPELLANT TANK PRESSURIZATION HELIUM USED DURING BOOSTER OPERATION.	1	1																	
	F 65 P LOZ TK HE LIN @ ORFC	0	0																	
	F 246 P & TANK HE BOTTLES HE	0	0																	
	F 14 T LG2 PRESS ORFC IN	Ş	e																	
	F 247 T & TANK HE BOTTLES	0	О																	
FE58	DEMONSTRATE ADILITY OF CONTROLS PREUMATIC SYSTEM TO PROVIDE PRESSURIZATION FOR FLIGHT REGUIREMENTS.	2	2	1	ì	1	1	1	1	2	2	2	2	2	2	2	2	2	2	
	F 145 P S CTU HE BTE DI ICH	o	0	0	0	O	U	0	0	Ü	0	0	g	o	c	0	٥	O	٥	
	F 290 T S CTL HE BOTTLE	0	٥																	
	P 27 P VERNIER FUEL TANK	٥	0				0	3	0	0	0	2	C) 0	:	Q	0	0		

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15 MAY 1961

E FL	IGHT	08J.	СОМ	P0511	Ε	15 MA	Y 61		3	4	8	9	12	13	16	17	18	21	22	25	26	30	32	35	36	40	(19
	ρ	30 P	VER	NIER	L02	TANK			0	0			O	0	0	0	0	0	0	0	0		0	0	С)		
	Ρ	474 P	v (TL PR	ESS	REG	0U T	,	0	0	0																	
FE59	FUEL	LUATE "AND JLATOR	FUS.				OF										2	2	2	2	2		2	2	2	!		
	A	781 C	BAS	E LOX	TK	P RE	G RD)									0	0			0							
	A	782 C	BA S	E LOX	ΤK	PRE	G LG	,									0	0			0							
	A	783 C	D BAS	C LOX	£K	PRE	G 16	,									Q	0			ن							
	A	784 C	LOX	TK P	RE	G RAD	[AL														0							
	A	785 (O LOX	TK P	RE	G TAN	G														0							
	A	786	C BAS	EFT	K P	REG	CAR												0	0			0	0				
	A	787 (O BAS	EFT	Kβ	REG	LONG	ົວ											0	0			0	o				
	A	788	O BAS	E F 1	KF	REG	TANG	ົວ											0	9			0	0				
	A	789 (o FUE	LTK	PF	REG RA	DIAL	L															0	0				
	A	790	0 FUE	L TK	p 5	REG TA	NG																0	0				
	A	925 (0 L0)	CTKF	2 3 5	G RAD	IAL										С	0										
	A	926	0 1.0)	CTKF	9 9 9	C TAN	16										12	0										
	A	930	Q FUE	L TK	PF	REG RA	DIA	L											0	0								
	A	931	O FUE	L TX	P	REG TA	NG												0	0								
	X	0000	X UNG	DER CO	ONS	i dera 1	ICA																		(0		
F£61	OF	AIN D. MISSI UND P	LE B	DRNE A	. ئەن د	TION C	٦F										2											
	A	18. 5	T RO	T INV	TR :	32 G2						٥					0											
	A	16.7	T RO	INV	TR (82 22						0					0											
	A	1808	T RO	T INV	TK :	32 32						3					0											
	4	1839	f R0	T INV	TR :	82 32						3					0											
	Ą	1810	T RO	TINV	ĪŖ	82 SŽ						٥					Ç											
	A	1815	T RO	TINV	13	92 02						٥					0											
	Ą	1816	1 30	I INV	7 4	82 J.						o					5											
	4	1817	⊺ २०	T [1%)	* R	82 32						٥					`											
	A	1816	1.47	P GYR	0 3	R 30 P	ÝΥ					.3					0											
	A	1819	T A2	ا ال	• 5	3 ××						3					Э											
	A	1820	T 14	via o	A.T	82 PC	o oz					2					٥											
	4	1622	† 3£	P	1 0	00 24						3					٤											
	A	1523	- اد	Ps ç	: 0	22 44						;					3											
	A	182-	ا عد	59 P	; >	op 24						3					3											
	*	1931	7 j€	€ 5 €	i P	an 34						Ü					3	:										

SECTION 9

CONFLOCATHAL

15 MAY 1961

E FLIGHT OBJ. COMPOSITE 15 MAY 61	3 4 8 9 12 13 16	17 18 21 22 25 26 30 31 35 36 40	020
A 1902 T GE PB B1 POD 04	o	٥	
A 1903 T GE PB B1 POD Q4	٥	0	
A 1904 T GE PB BE POD 94	c	c	
A 1935 T GE Pd 61 POD G4	0	0	
A 1906 F GE R8 81 POD 04	0	0	
A 1907 T GE 98 01 750 04	С	0	
A 1908 T GE RB B1 POD G4	0	0	
A 1909 T GE RB 51 POD Q4	0	0	
A 1910 T GE Re bl POD Q4	٥	o	
A 1911 T GE Re 91 POD Q4	0	0	
A 1912 T GE RH 81 POD Q4	0	o	
A 1936 T GE R8 81 POD Q4	0	0	
A 1937 T TLM #2 B1 POD Q1	0	0	
A 1938 T TEM #2 B. POD Q1	0	0	
A 1939 T TLM #2 B1 POD Q1	c	0	
A 1940 T TLM #2 B1 POD Q1	0	3	
A 1941 T TLM #2 B1 POD 31	Э	o	
A 1942 T TEM #2 B1 POD Q1	٥	^	
A 1943 T TLM #2 81 900 01	0	0	
A 1944 T TEM #2 B1 POD 31	3	0	
L 1452 P PORT MANO	0	o	
L 1453 P PORT MANO	Э	0	
L 1454 P VENTRI PITOT TUBE SI	0	O	
L 1455 P VENTRI PITOT TUBE 52	0	0	
L 1456 P VENTRE PETOT TUBE SE	3	0	
L 1457 P VENTRE PETOT TUBE 54	0	e e	
L 1458 P VENTRE PETOT TUBE 55 L 1462 P VENTRE PETOT TUBE TE	٥	0	
E 1463 P VENTRE PLIGHT TUBE TO	0	0	
E 1464 P VENTRE PITC (CGE 13	9 e	٥ ي	
L 1465 P VENTRE FIRST TORE TO	Ċ.	2	
E 1466 P VENTRE PETOT TOUS IN	2		
£ 1650 7 PORT THERE	2	3	
E 1451 T PO展示 THEHM 2	٥	٥	
£ 1459 t P287 THERE 3		2	
£ 1855 € PQRE THERM &	;	* 2	
£ (+6) ° PÇR↑ 19ERW 5		0	

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SECTION 9

15 MAY 1361

E F	LIGHT	QBJ∙	COMPOSITE	15 MAY 61	3	4	8	9	12	13	16	17	18	21	22	25	26	30	32	35	36	40	021
	н	413 0	NAA CONTROL	L Z AXIS			o																
	н	3 P	B HYD PUMP	DISCH		0																	
	н	33 P	B1 HYD ACCU	UMULATOR	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	н	34 P	B2 HYD ACCU	JMULATOR		0																	
	н	52 P	S HYD ACCUM	MULATOR		0	0		0	o													
	н	130 P	S HYD PUMP	DISCH	0	0	0	0	0	0	O	0	0	0	0	0	0	0	0	0	0	0	
	н	140 P	SUS/VERN HY	YD PRESS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	H	185 P	S HYD PUMP	INLET		0	0	0	0	0	0	0	٥	0	0	0	0	0	0	0	0	0	
	н	191 P	S HIGH PP 1	TO MAN			0	э	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	н	219 P	S TK RESVR	GAS				0	0	0													
	н	224 P	B HYD SYS L	O PRESS		0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	н	225 P	8 TK RESVR	GAS				0	0	0													
	н	379 P	SUS ROD LIN	NE HI PP			0	0															
	н	380 P	SUS STAGE L	INE HI PP			0	0	0														
	н	381 P	BOOSTER ROD	LN HI PP			0	0						,*									
	Н	398 P	NAA HYD ACC	UM GAS			0	٥	0	0													
	н	408 P	HS VALUE OF	PEN			o																
	н	409 P	PU VALUE OF	PEN			0																
	н	410 P	GG VALUE OF	PEN			0																
	н	383 R	SUS FLOW TO	RES			0	0	0	0													
	H	384 R	SUS FLOW TO	NAA CONT			0	0	0	0													
	н	385 R	SUS FLOW FR	OM V SOLO			0	0	0	0													
		HYDRA	ULIC SYSTEM																				
HE51	HYDR		A FOR ANALY System Perf		2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	
	н	33 P	B1 HYD ACCU	MULATOR	0	0	0	0	0	U	0	0	0	٥	0	o	0	0	0	0	0	0	
	н :	130 P	S HVD PUMP	DISCH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	н ;	140 P	SUSZVERN HY	D PRESS	0	0	0	0	0	0	٥	0	0	0	0	0	0	0	0	0	0	0	
*	н :	185 P	S HYD PUMP	INLET	О	0	0	0	0	0	0	0	0	0	0	0	0	0	0	٥	0	0	
	н :	191 P	S HI PP TO	MANIFOLD			o	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	н :	212 P	VERNIER RET	URN			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	н ;	224 P	8 HYD SYS LO	O PRESS		0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	н 1	360 P	HPU SUSTAIN	ER RETURN			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
	н 1	187 X	BSTR OIL EV	ACUATION			0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
							_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	_	

H 1188 X SUS OIL EVACUATION

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E FL	IGHT	08J.	COM	PO51	TE	15	MA	Y 6	1	3	4	8	9	12	13	16	17	18	21	22	25	26	30	32	35	36	40	0	02	2
нЕ53	SUS SYS	ONSTRA RAULIC TAINER TEM TO SSURES	POW HYD SUP	ER S RAUL	IC IC	PO1	AND VER		R	2	1	1	1	ı	1	1	2	2	2	2	2	2	2	2	2	2	2	2		
	Ħ	382 0	SUS	TAIN	IER	HYſ) PU	MP				0	0																	
	H	411 G	NAA	CON	ITRO)L)	(AX	15				0																		
	н	412 0	NAA	CON	ITRO)L 1	r AX	15				0																		
	Ħ	38 5 R	SUS	FLC)W 1	0 1	MAN					0	0	0	0															
	н	1 T	вн	YD F	PUMF	, D	ISCH	ı											0	0	0									
	н	131 T	' S H	YD F	>UWS	0	ISCH	í											0	0	0									
	н	184 7	SKI	N S	HYS) PI	UMP					0																		
	н	3 16 T	ROD	PAN	4EL	SU	S IN	ı				0	٥		0															
	н	317 T	ROD	PAN	4EL	во	OSTE	RI	N			0	0		0															
	¥î	387 X	. S E	NG (:TL	BR	ACKE	. 7				. 0	9	0	0															
	н	388 X	ENG	CN1	rc i	ro i	PR L	INE	Ē			o	G	0	0															
	н	389 X	HYD	- FIA!	VIF(OLD	то	CON	ŧΕ			0	0	0	0															
HE55	DET	ERMINE	184	LITY	Y 01	F V	ERNI	ER		2	2						1	2	2	2	2	2								
	VID	C HYDR E HYDR NIER S	AULI	C PC	OWER	₹ 01	URIN		•																					
	Н	140 P	SUS	/VEF	RN H	IYD	PRE	SS		0	0	0	0	0	0	0	0	0	0	0	0	0								
	н	21 2 P	VER	NIER	≹ Rŧ	£TUI	RN					0	0	0	3	0	0	0	0	0	0	0								
		ELEC	TRIC	AL S	5YS1	rem																								
EE51	ELE	AIN DA CTRICA EATABI	L SY	STEN					:	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	;	2	2		
	E	66 C	MIS	SILE	E DO	: A!	MPS																	0	0					
	Ε	50 0	400	CYC	CLE	ΑÇ	PWR	SUP	•	0	0	O	0	0	0	0	0	0	0	0	0	0	0	0	э	c)	٥		
	E	28 V	MSL	SYS	STEN	45	INPU	T		G	0	c	0	0	0	0	0	0	0	0	0	0	0	0	0	C)	0		
	£	51 V	400	CYC	LE	AC	РНА	SE	A	0	0	o	0	o	0	o	o	0	0	э	0	0	0	0	0	o	. (0		
	E	53 V	400	CYC	LE	AC	PHA	SE	c	٥	0	0	٥	o	0	0	0	0	0	0	0	o	0	0	0	٥) (0		
	1	540 V	CON	TROL	. 11	.5 F	PHAS	E B		0	0	0	٥	0	٥	0	٥	0	0	٥	0	o		0	٥	0)			
		PENE	TRAT	104	SY5	TER	1																							
ME57		LUATE TANK F																							2	2	!			
	D	3 X	RSC	DES	TRU	ICT.	0U T	PUT																	0	Ó	,			
	F	1 P	LOX	TAN	IK H	ELI	MU																		0	0				
	F	3 P	FUE	L TA	INK	HEL	.IUM																		0	0				
	I	513 A	ACC	EL X	(F 1	OIF	RECT																		0	0				

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E FL	IGHT OBJ. COMPOSITE 15 MAY 61	3 4 8 9 12 13 16 17 18	21 22 25 26	30 32 35 36	40 023
	1 514 A ACCEL XF2 DIRECT			0 0	
	I 516 A ACCELEROMETER YE.			0 0	
	1 517 A ACCELEROMETER ZF1			0 0	
	1 519 A ACCELEROMETER YF2			0 0	
	I 520 A ACCELEROMETER ZF2			0 0	
	1 521 X VERN ENGINE COF SIG			c 0	
	P 548 % COMPLETE COF RELAY			e o	
	5 52 R ROLL RATE GYRO SIG			ი ა	
	S 53 R PITCH RATE GYRO SIG			0 0	
	S - 54 R TAW RATE GYRO SIG			c 0	
	S 151 % TANK FRAG DESTRUCT			0 0	
	S 248 Y A/P PG SWITCH 17			0 0	•
	5 391 X THOR BETROROCKET CMD			υ c	•
ME59	EVALUATE CLOSED-LOOP OPERATION OF TANK FRAGMENTATION SYSTEM. /EFFECTIVITY NOT YET DETERMINED/ x cooo x effect not yet estab				
KĒ60	CHIAIN DATA ON MODIFIED AUTOPILOT COMPONENT OF TANK FRAGMENTATION SYSTEM.	ā	:	2	2
	S 151 X TANK FRAG DESTRUCT)	0	o
мЕ7о	DEMONSIRATE COMPATIBILITY OF DECOY POD/S/ WITH ALL MISSILE SYSTEMS.	•	2 2	2	:
	A 46 T MISSILE IK NR ADF	(0 0	C	
	A 47 T MIST'LE TK NR ADE	(0	C	
	A 48 Y MISSILE TK NR ADF	ŧ	o	()
	A 49 T MISSILE TK NR ADF	(o e	()
	S 52 R ROLL MATE GYRO SIG	•	0 0	()
	S 5% R PITCH RATE GYRO SIG	1	0	()
	S 54 R YAW RATE GYRO SIG		0 0	(

NONHEAPON SYSTEM

THIS MATERIAL CONTAINS IMPORMATION AF ECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS, TITLE

AT LECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE PRANCISION OF BYTELLO OF WITHIN IN ANY MARKET TO AN UNIQUE CONTROL OF WITHIN ANY MARKET TO AN UNIQUE CONTROL OF WITHIN ANY MARKET TO AN UNIQUE CONTROL OF WITHIN IN ANY MARKET TO AND UNIQUE CONTROL OF WITHIN IN ANY MARKET TO AN UNIQUE CONTROL OF WITHIN IN ANY MARKET TO AN UNIQUE CONTROL OF WITHIN IN ANY MARKET TO AN UNIQUE CONTROL OF WITHIN IN ANY MARKET TO AN UNIQUE CONTROL OF WITHIN IN ANY MARKET TO AN UNIQUE CONTROL OF WITHIN IN ANY MARKET TO AN UNIQUE CONTROL OF WITHIN IN ANY MARKET TO AN UNIQUE CONTROL OF WITHIN IN ANY MARKET TO AN UNIQUE CONTROL OF WITHIN IN ANY MARKET TO AN UNIQUE CONTROL OF WITHIN IN ANY MARKET TO AN UNIQUE CONTROL OF WITHIN IN ANY MARKET TO AN UNIQUE CONTROL OF WITHIN IN ANY MARKET TO AN UNIQUE CONTROL OF WITHIN IN ANY MARKET TO AN UNIQUE CONTROL OF WITHIN IN ANY MARKET TO AN UNIQUE CONTROL OF WITHIN IN ANY MARKET TO AN UNIQUE CONTROL OF WITHIN IN ANY MARKET TO AN UNIQUE CONTROL OF WITHIN IN ANY MARKET TO ANO

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E FL	IFHT OBJ. COMPOSITE 15 MAY 61	3	4	8	9	12	13	16	17	18	21	22	25	26	30	32	35	36	40
ME61	DEMONSTRATE COMPATIBILITY OF AFSWC PHAGE III POD WITH ALL MISSILES SYSTEMS.										3		3	3			3	3	
	A 51 T MISSILE TK NR AFSWC										0		0	Q					
	A 52 T MISSILE TK NR AFSWC										0		0	0					
	A 53 T MISSILE TK NR AFSWC										0		0	0					
	A 54 T MISSILE TK NR AFSWC										0		0	c					
	A 55 T MISSILE TK NR AFSWC										0		0	0					
	X 0000 X NO MEAS REQ															o	0	0	
ME&2	DEMONSTRATE COMPATIBILITY OF MARK 5 RV WITH ALL MISSILE SYSTEMS.					1					1		1				1	1	
	Y 1 X SEPARATION SIG					0					0		0				0	0	
ME63	DEMONSTRATE COMPATIBILITY OF RVX-2A RV WITH ALL MISSILE SYSTEMS.															1			
	X 0000 X NO SPECIFIC INSTR															0			
ME64	OBTAIN DATA ON PERFORMANCE OF STROBELIGHT OPTICAL BEACON SYSTEM:		2		2	3	3	3	3	3	3	3	3	3		3	3	3	
	M 78 x STROBELIGHT OCCUR		0		0	0	С	0	0	0	0	0	0	0		0	0	0	
	X 0000 X GE-IP GND STA DATA		0		0	9	0	0	0	0	0	0	0	0		Q	0	0	
	X 0000 X AZUSA GND STA DATA		0		0	0	0	0	0	Ç	0	0	0	0		0	0	0	
	X 0000 X BC-4 CAMERA DATA		0		0	0	o	0	0	0	0	0	Ó	0		0	O	o	
ME66	OBTAIN DATA ON PERFORMANCE OF TELEMETRY SYSTEM	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	/PRIORITY OF INDIVIDUAL CHANNELS ESTABLISHED BY PRIORITY OF DATA/.																		
	X 0000 X SIGNAL STRENGTH	0	0	0	0	o	0	0	0	0	e	0	0	0	0	0	٥	0	0
ME67	OBTAIN DATA PERFORMANCE OF GE MOD III-E SYSTEM.	3	3	3	3	3	3	3	3	3	3	3	3	3		3	3	3	
	G 302 C PB-IP MODULATOR AVG	0	O	0	0	0	0												,
	G 504 C MOD III MAGNETRON	0	0	0	0	0	0	0	C	۰٥	0	0	٥	0		0	ί		
	G 582 E MOD III RB RF OUTPUT	0	0	С	0	0	0	0	6	o	0	0	0	0		0	0	e	
ME68	OBTAIN SATA ON PERFORMANCE OF AZUSA SYSTEM.	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	3	3	3
	X 9145 N RAW AZUSA DATA	0	0	o	o	o	O	C	0	0	O	0	٥	0	0	0	0	o	0
	Z 3 E XPONDR RF INPUT AGC	0	O	0	ΰ	0	0	0	0	0	0	0	0	0	0	0	O	0	0

THIS MATERIAL CONTAINS INFORMATION AFFECTING THE MATIONAL DEFENSE OF THE UNITED STATES WITHIN THE IS, U.S.C. SECTIONS 713 AND 734, THE TRANSMISSION OR REPELATION OF WHICH IN ANY MALMER TO AN UNSUIT

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E FL	IGHT OBJ. COMPOSITE 15 MAY 61	3	4	8	y	12	13	16	17	18	21	22	25	26	30	32	35	36	40)		025
ME&9	DETERMINE VIBRATIONAL ENVIRONMENT OF GE MOD III-E SYSTEM				3	3	3		3													
	G 94 O BOC ' ANTENNA				0	0	0															
	G 196 O PO-IP RADIAL								0													
	G 197 O RB-IP RADIAL				0	0	0															
	G 587 O FOD WAVEGUIDE				0	0	0		0													
	G 595 O PB WAVEGUIDE RAD								0													
ME71	DEMONSTRATE COMPATIBILITY OF SCIENTIFIC PASSENGER POD/S/ WITH ALL MISSILE SYSTEMS.									2	2		2	2		2	2	. 2	i ·			
	X 0000 X NO SPECIFIC INSTR									o	0		0	0		0	o)			
	FACILITIES-MISSILE COMPAT																					
LE51	DEMONSTRATE OPERATION OF PEDESTAL TYPE LAUNCHER UNDER SERIES E WEIGHTS, ENGINE THRUSTS, AND ENVIRONMENTAL CONDITIONS.	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	. :	1		
	X 9176 N PHOTO COVERAGE	0	0	0	0	0	0	0	0	0	٥	0	0	0	0	0	0) (0		
LE53	DEMONSTRATE ABILITY OF LAUNCH RISE-OFF DISCONNECTS AND UMBILICALS TO PERFORM THEIR FUNCTIONS.	2	2	ì		2			2		2											
	L 13º8 D MSE VS DISCON Q1 & 2	0																				
	L 1399 D MSL VS DISCON Q3 & 4	0																				
	X 9176 N PHOTO COVERAGE	o	0	0		0			0		0											
	X 0000 X POST TEST INSPECTION	0	0	O		0			0		0											
LE54	ESTABLISH THAT TECHNIQUES AND PROCEDURES FOR TESTING. OPERATING AND EVALUATING MIS- SILE AND SUPPORT EQUIPMENT PRODUCE FLIGHT READINESS.	2,	2	2		2			2		2											
	X 3000 X NO SPECIFIC MEAS	x	x	x		x			x		x											
L:55	DETERMINE LOADS ON HOLD-DOWN HOOKS DURING FRF.	1																				
	E 1401 S HD HOOK STRAIN Q1	c																				
	L . J2 S HD HOOK STRAIN Q2	0																				
L£56	DETERMINE TEMPERATURE OF LOWER	2																				
	PEDESTAL FACES DURING FRF.																					
	L 1405 T L PED INNER FACE Q1	0																				
	£ 1407 T £ PED 1075R FACE Q3	0																				
	L 1415 T GI PEDESTAL DELTA T	0																				

RIAL CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENDE OF THE UNITED STATES WITHIN THE N
SECTIONS 793 AND 784. THE TRANSMISSION ON MYDIATION OF WHICH IN ANY MAGNITUDE AND UNITED THE UNITED STATES WITHIN WAS THE SECTIONS 793 AND 784. THE TRANSMISSION ON MYDIATION OF WHICH IN ANY MAGNITUDE AND UNITED SECTIONS.

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LEST	0150	RMINE IONNEC II SSIL	T PA	NEL	WIT	H R	ESPE	CT	2																	
	L I	1398 D	MSL	٧٥	DIS	CON	01	6 2	0																	
	L I	1399 D	MSL	٧s	DIS	CON	Q3	6 4	0																	
NE51	MIS	ABLISH SILE • TROL E	RFOC	KHO	JSË			INCH	1	2	2		1			2	i	2								
	X	0000 x	CNO	.₃PE	CIFI	(C M	EAS		0	0	0		G			0	(0								
NE52	PRO ABI	ABLISH CEDURE LITY (TEM T(S AN	ID D	EMON LLAN	NSTE NT 1	RATE FANK	ING	1	2	2		1			2	i	2								
	υ	1091 \	V ERR	ROR	RAT	:01	EMO	O OP	0	0	0		0			o		0								
	U	1200	x LOZ	2 10	C%	SLU	3 CO	F-1	0	0	0		0			0		0								
	U	1201	x LOZ	2 10	PG i	HI (CTL-	1	0	o	Q		0			0		0								
	U	1202	x LO	2 T.C	PG	LO 4	CTL-	1	0	0	O		0			0		O								
	IJ	1203	x LO	2 95	% R	API	D LO	AD-1	0	0	0		0			0		0								
	U	1204	X FUE	EL 1	.00%	SE	с ст	L	0	0	0		0			0		0								
	Ü	1205	x FU	EL 1	.၁၁%	PR	1 CT	L	0	0	0		0			0		0								
	U	1206	x Fui	EL 9)5%	SEC	CTL		0	0	0		0			О		0								
	U	1207	X FU	EL S) 5 %	PRI	CTL		0	0	0		0			0		0								
	U	1238	X LO	2 10)0 %	SLU	G C	F-2	О	0	0		0			0		0								
	U	1209	X LO	2 10)PG	ні	CTL-	- 2	0	0	0		0			0		0								
	U	1210	X LO	2 10)PG	LC	CTL-	. 2	c	0	0		0			0		0								
	U	1211	x LO	2 4	5%a R	API	D LC	AD-2	o	O	0		0			0		0								

ASSOCIATE CONTRACTOR SYS

THE FOLLOWING LIST PROVIDES THE BEST INFORMATION AVAILABLE TO EVA ON ASSOCIATE CONTRACTOR TEST OBJECTIVES. THESE OBJECTIVES ARE PROVIDED FOR INFORMATION ONLY G ARE SUBJECT TO CHANGE AT ANY TIME. THE OBJECTIVE NUMBER AT LEFT IS FOR CONVENIENCE G HAS NO RELATION TO ANY APPROVED NUMBER SYSTEM.

THES MATRIMAL CONTAINS IMPORTATION AFFECTION THE PATIONAL DIFFERSE SF THE MATRIX STATES WITHIN THE MEANING OF THE EMPLOYAGE LAWS, FITTLE IS, U.S.C. MECTIONS THE MAD THE THE PRANSMINGACION OF EVELLATION OF MADICAL HEAVY MANAGER TO AN UNKNOTUMENTED THE PRANSMINGACION OF PROCESSES BY LAW.

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E FLI	GHT OBJ. COMPOSITE	15 MAY 61	3	4	8	9 1	2 1	3 ;	5 I	7 16	3 2 1	. 22	25 2	6 30	32 3	5 36	40
	RE-ENTRY VEHIC	LE /KV/															
YL71	EVALUATE THE PERFOR ARMING & FUZING SYS			1							1						
Y=72	EVALUATE PERFORMANCE /HEATING. LOADING.			1			1	1									
	STABILITY. & SEPARA	TION/.															
Y ċ 73	DEMONSTRATE COMPATI THE RV WITH THE E S MISSILE, IN PARTICU FLIGHT CONTROL SYST	ERIES JLAR, THE	2														
YE74	DETERMINE PERFORMAN /HEATING, LOADING, STABILITY, ARMING & SEPARATION./	ABLATION,	2				1			1							
YÈ 75	DEMONSTRATE THE PER ARMING & FUZING SYS					1		1		2							
YE76	DETERMINE THE PERFO THE RV ARMING AND I TEMS.				1		1		1								
Yc77	DETERMINE THE COMPO OF THE RV WITH ALL SUB-SYSTEMS.				1						1						
YE76	OBTAIN DATA ON PENI CHARACTERISTICS DUI ENTRY PHASE.				3	3		3	2	3	1						
Y = 7 y	DEMONSTRATE R/V SU PERFORMANCE	bSYSTEM							2								
Ytou	EVALUATE THE MARK MATERIAL PERFORMAN RE-ENTRY.											1					
YEBl	DETERMINE THE MARK AERODYNAMIC HEATIN AND STABILITY JURI	U. LUADING										1					
YEOŻ	DETERMINE THE HANK SEPARATION AND HAM FUZING SUBSYSTEMS	G.S. AND										1					
	ล ลสหยังม <i>่าได</i> ช/																
4 271	beton The Am Post ZBANDIAZ.	M TARKE				I			1								
KĘÍ.	SVACUATE AM FEICHT AND ITS ADILITY TO HANGE OFFICTION HO	i ka taka ili				1											

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E FLIGHT OBJ. COMPOSITE 15 MAY 61 3 4 8 9 12 13 16 17 18 21 22 25 26 30 32 35 36 40 028

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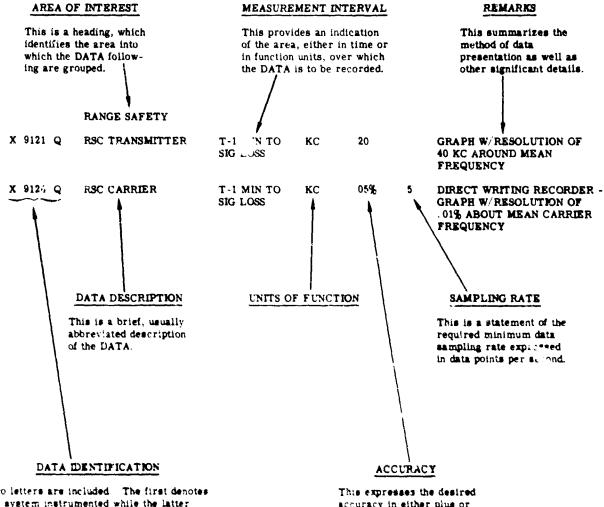
GUIDANCE

- TETT EVALUATE INERTIAL GUIDANCE 2 ! 1 1 1 1 1 1 1 SYSTEM PERFORMANCE S ACCURACY ZARMAZ.
- IETZ EVALUATE INERTIAL GUIDANCE 1 1 SYSTEM COMPATIBILITY WITH ALL ASSUCIATED MISSILE SUBSYSTEMS /ARMA/.
- 1673 DETERMINE PERFORMANCE OF AIG 2 2 2
 ALIGNMENT-COUNTDOWN SET AND
 ASSOCIATED GSE /ARMA/*
- 1274 EVALUATE PÉRFORMANCE & ACCURA- 1 CY OF THE GUIDANCE SYSTEM IN-CEUDING MGS & GSE ZARMAZ.
- 1875 EVALUATE PERFORMANCE & ACCURACY OF THE MGS INCLUDING COVPUTER, PLATFORM, CONTROL UNIT,
 AND ANALOG & DIGITAL CONVERTERS /ARMA/*
- 1E76 DEMONSTRATE MGS COMPATIBILITY WITH ALL ASSOCIATED MISSLE SUBSYSTEMS /ARMA/*
- IE77 DETERMINE OPE AL SUITABILITY O III ALIGNMENT-COUNTOUNN SET /ARMA/*

SECTION 10

RANGE DATA

This section presents a grouping of the data which is gathered externally, to the missile, by the range. Note that this section is presented by Areas of Interest. The following is a brief explanation of the format used in this section.



Two letters are included. The first denotes the system instrumented while the latter indicates the type of measurement. The four numerical digits province an identification of the measurement within the system indicated by the first letter.

This expresses the desired accuracy in either plus or minus units of function, or in percent of actual value measured.

1)

15 HAR 60		E SERIES AMR RANGE DATA	ZANGE	DATA	FAGE 001
v> -		TRAJECTORY	PAAP.		
MEAS	DESCRIPTION OF DATA	INTERVAL) S !	DATA	PRESENTATION AND OTHER
2 2 2 2 3		COVERED	a G	ACCURACY	REMARKS
	FLIGHT TRAJECTORY				
	POSITION				
Х 9128 Н	VEHICLE XYZ VS TIME	0-5000FT	~	CLASS 1	TAB/18M CARDS OR MAGNETIC
		5000 FT+8ECO BECO-VECO PLUS 10 SEC	40	25 FT 500 FT	
		C-5000FT	~	CLASS 11	
		5000 FT-BECO BECO-VECO	~~	10 FT 100 FT	
		VECO-RV SEP	~	50 FT	
		RE-ENTRY TO	~	100 FT	
x 9145 x	AZUSA DATA	TO LIMIT OF AZUSA	2		IBM 729 TAPE WITH REAL TIME FLIGHT DATA, PHASE DATA TAPE PLAYBACK OF AZUSA, COPY OF LOG FROM AZUSA SITE-LIST PHENOHENA OBSERVATION INCLUDING L. M, AND R CHANNEL STATES, OSC ROLLS PLUS CALIBRATION SHEETS, AMPEX FRIIA TAPES,
X 9150 H	RANGE SAFETY IP	LAUNCH TO IMPACT	U		COPY OF EACH STANDARD RANGE SAFETY GRAPH•
Х 9192 Н	HILS IMPACT POINT	SPLASH NET	~	CLASS 1 0.5 NM	TAB EXPRESSED IN GEODETIC AND GEOCENTRIC LATITUDE 6

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. 5 MAR 60		E SERIES AMR RANGE DATA	E DATA	PAGE 002
		IMPACT	CLASS 11 0+1 NM	LONGITUDE FOR SPLASH NET IMPACTS.
X 9151 H	SOFAR IMPACT POINT	AT NOSECONE 2 IMPACT	CLASS I 0.5 NM CLASS II 0.1 NM	TAB EXPRESSED IN GEODETIC AND GEOCENTRIC LATITUDE 6 LONGITUDE FOR SPLASH NET IMPACTS.
X 9152 H	AZUSA IMPACT POINT	AT IMPACT 2	0.5 NM	TAB.
X 9154 X	H RADAR IMPACT POINT H TERMINAL TRAJECTORY	AT IMPACT 2 PAYLOAD SEP 2 TO IMPACT	NN NO OO	TAB. GRAPH OR TAB.
x 9177 +	H MOD III INST SYS IP	AT IMPACT 2	NN 5.0	TAB.
	VELOCITY			
X 9156 1	L VEH XYZ & RESULTANT		CLASS 1	TAB. 18M CARDS OR MAGNETIC
•		0-5000FT	2 F/S	TAPE. DERIVE FROM POSITION
		•	2 15 F/S	
		PLUS 10 Sec	CLASS 11	
		0-5000F1	-4	
		8	2 1 F/S	
			9	
			2 10 F/S	
		PLUS 10 SEC RE-ENTRY TO	2 100 F/S	
		BECO-VECO	CLASSIII 2 0.1 F/S	- .
		PLUS 10 SEC		
	ACCELERATION			
x 9158	A VEHICLE XYZ		CLASS	TAB. IBM CARDS OR 729 TAPE
			100	INCLUDE METIOD USED.
		5000 FI-BECO BECO-VECO	0 0 6 4 4 7 6 6 7 7	
		PLUS 10 SEC	** 334 .7	
		0-5000FT 5000 FT-8ECO	2 0.05 G 2 0.05 G	

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15 MAR 60		E SERJES	AMR P	SERIES AMR RANGE DATA	¥.		PAGE 004
							AND T-A40.
₽ # # # # * * * * * * * * * * * * *	TEMP VS ALTITUDE	SURFACE D-200K	t.	u o	NN	000 000 000	GRAPH OR TAB. RAWINGSONDE RECORDING TO BE HADE AT LAUNCH. SOUNDING TO BE CHOSEN BY WEATHER STAFF AS INDICATIVE OF LAUNCH COND- HADE AT LAUNCH, T-60. HADE AT LAUNCH, T-60. 1-120, T-12', T-240, T-300 AND T-360.
7 9146 X	WIND SPEED	SURFACE		Ų		۶/ ک	SCHOOL MET AC HORDS
		C-25x	FT	, ,	· c) V	TOTAL TO THE STREET OF THE STR
		25K-15K	F	Ū	2	, . L	TAURCH SOURCES TO BE
4 - 4		45K-200K	<u>-</u>	U	2	F/S	CHOSEN OF WEATHER STAFF AS NOTCATIVE OF LAUNCH COND- TITIONS- OBSERVATIONS TO BE MADE AT LAUNCH- 1-60.
							T-120. T-180. T-240. T-300 AND T-360.
2 416 X	WIND AZINUTH	SURFACE	į	U	2	DEG	GRAPH OR TAB. RAWINGSONDE
		0-2×K	ا ب دا	U	S	056	RECORDING TO SE MADE AT
		25K-45K	1	U	u i	OEG	LAUNCH. SOUNDING TO BE
		45K-200K	-	U		9 20	CHOSEN BY WEATHER STAFF AS INDICATIVE OF LAUNCH COND- ITIONS. OBSERVATIONS TO BE MADE AT LAINCH, T-60.
							1-1209 1-1509 1-2409 1-300 AND 1-360
X 84 116 X	RELATIVE HUMIDITY	AT LAUNCH POINT.	_	U	'n	æ	OBSERVATION TO BE MADE AT LAUNCHS T-60. T-120. T-180 T-240. T-300. AND T-360.
₩ 0216 X	VISIBILITY	AT LAUNCH POINT.	_			ž	ACCUPACY -0.5NM LESS THAN LONN. INM GREATER THAN
							LYNMA 08SERVATION TO BE MADE AT LAUNCHS T-60, T-120, T-180 T-240, T-300, AND T-360,
X 9207 N	PRECIP11ATION	AT LAUNCH POINT.		Ü	0.05	Z.	OBSERVATION TO BE MADE AT LAUNCHS T-60: T-120: T-160: T-240: T-300: AND T-360:

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15 843 60		E SERIES ANR RALGE DATA	PAGE 005
3 8316 ×	מרפחס כפאנשאפני	AT LAUNCH 0.1 % POINT.	OBSERVATION TO BE MADE AT LAUNCHS 1-60, 7-120, 1-160 1-240, 1-360, AND 1-360.
	DOCUMENT ARY		
x 9176 N	PHOTO COVERAGE	AT LAUNCH.	AS ESTABLISHED 3Y CV-A MOTION PICTURE SECTION.
	GEOPHYS1CAL		
м 9195 X	LAUNCH SEO LOCATION	LAUNCH POINT	ACCURACY—FIRST ORDER SUR- VEY DATA TO BE PROVIDED WITH WEFERANCE TO CLARKES SPHENDID OF 1866. A AXIS-POS. ALONG PCHOVER AZIMUTH.YAXIS-POSITIVE 90 DEGREES COUNTER CLOCK- WISC FROM FOSITIVE X AXIS. Z AXIS-POSITIVE UPWARD. ORIGIN-INTER-ECTION OF CONGITUDINAL AXIS OF ERECTEE VEHICLE AND LAUNCIS STAND LOCK PINS AXIS. SYMBÖL EXPLANATION * BEST DATA AVALABLE

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SECTION 11

APPENDIX A

INSTRUMENTATION CODE KEY

CONVAIR-ASTRONAUTICS

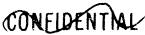
REPORT NO. AZC-27-059

SECTION 11

APPENDIX

E SERIES
IBM CODE KEY

THIS DOCUMENT CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS, TITLE 18, U.S.C., SECTIONS 793 AND 794. THE TRANSMISSION OF THE REVELATION OF ITS CONTENTS IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW.



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APPENDIX A

INSTRUMENTATION CONFIGURATION

IBM CODE KEY

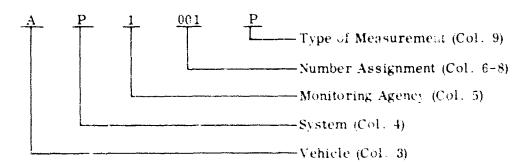
Master tabulations of all performance measurements applicable to all test articles are maintained by the Test Planning Group. Operational tabulations are compiled from these masters for individual missiles. All instrumentation logs are maintained on IBM punched cards. This facilitates rapid sorting, rearrangement, and tabulation of measurements as required for program preparation and data analysis. Such storage necessitates a systematic classification of the measurements and uniformity in method used to describe the many types of measurements. To achieve this, an extensive coding of the identification, description, and measurement parameters is necessary. The following is an explanation and key for this coding. Each section may be identified in the key by the section heading or the IBM card column number.

I. VEHICLE IDENTIFICATION (Col. 3)

This column identifies the vehicle or, which the parameter being measured is located.

II. MEASUREMENT IDENTIFICATION (Col. 4-9)

A. Each measurement has a unique six-character identification. The first character defines the system within which the measurement exists. The second character defines the monitoring agency. The third, fourth, and fifth characters are number assignments which define a particular measurement within the system defined by the first character. The sixth character defines the type of measurement.



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	VEHICLE	SYSTEM	TYPE OF MEASUREMENT
SYMBOL	(Col. 3)	(Col. 4)**	(Col. 9)
A	Adlan Donaton	A 2 m C	Anna Nova Atlant
A	Atlas Booster	Airframe	Acceleration
B	•	*	Rotation Rate
C	Centaur	*	Current
D	*	Range Safety Command	Deflection
E	*	Electrical	Power
F	*	Pneumatic	Force
G	*	*	*
н	*	Hydraulic	Position
I	•	Guidance (Inertial)	Intensity
J	*	*	*
L	AGENA 2nd Stage	Launcher	Velocity
M	Mercury Capsule	Miscellaneous	Mass
N.	*	Facilities and Site	Camera Coverage
O	•	*	Vibration
P	•	Propulsion	Pressure
Q	*	*	Frequency
R	*	*	Rate
S	ABLE	Flight Control (SERVO)	Strain
T	•	Telemetering	Temperature
U	*	Propellant Utilization & Loading	ng *
v	*	* ·	Voltage
W	•	Weapon System	Time
X	•	External	Discrete Position
Y	*	Payload	Acoustical
Z	*	Azusa Transponder	Azimuth

- * Note: Unassigned
- ** For measurements made via Atlas telemetering system only.

MONITURING AGENCY (Col. 5)

- 0 Telemetering
- 1 Direct Line (Captive Test and AMR Landline)
- 3 Checkout and Validation Instrumentation
- 9 Range Data
- M Visual Panel Presentations

THIS DOCUMENT CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS TITLE IS U.S.C. SECTIONS 793 AND THE TRANSMISSION ON THE REVELATION OF ITS CONTENTS IN ANY MANNES TO AN UNAUTHORIZED PERSON IT PRONIBITED BY LAW

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Ш. MEASUREMENT RANGE (Col. 35-42)

This represents the desired capability of the measuring system. "M" preceding a number indicates minus quantity.

IV. UNITS OF FUNCTION (Col. 43-45)

AMP	Amperes	KPS	Kilo-pounds
CPS	Cycles per second	KPM	Thousands of RPM's
DB	Decibles	LBS	Pounds
DBM	Decibles above 1 Milliwatts	MA	Milliamperes
DEG	Degrees Angular	MC	Megacycles
DGC	Degrees Centigrade	ME	Milliwatts
DGF	Degrees Fahrenheit	MII	Microinches per inch
DGR	Degrees Rankine	MS	Milliseconds
D/S	Degrees per second	MV	Millivolts
E	Watts	PIA	Pounds per square inch absolute
F/S	Feet per second	PID	Pounds per square inch
FS^2	Feet per second ²		differential
FTC	Foot candles	PIG	Pounds per square inch gage
FTN	Foot ton	PPS	Pulses per second
G	Acceleration of Gravity	PS	Pounds per second
GPM	Gallons per minute	PSI	Pounds per square inch
GPS	Gallons per second	RPM	Revolutions per minute
HR(S)	Hours	RS^2	Radians per second ²
IN	Inches	SPS	Samples per second
INW	Inches of water	$\mathbf{U}\mathbf{V}$	Microvolts
ПВ	Inch pounds	UA	Microamperes
IPI	Inches per inch	VAC	Volts, alternating current
KC	Kilocycles	VDC	Volts, direct current
KID	Thousands of pound per	VPK	Peak volts, AC
	square in. differential	PRV	Phase reversing AC voltage

V. FREQUENCY RESPONSE REQUIRED (Col. 49-51)

The required response of the measuring system in cycles per second unless otherwise noted or implied.

ME UN TEO STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS TITLE

1

(D)

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SLO Less than 1 cycle per second

400 400 cycles per second

1KC 1 Kilocycle (1000 cycles) per second

2MC 2 Megacycles (2,000,000 cycles) per second

STP Step Function

UNK Unknown

VI. TYPE OF TRANSDUCER (Col. 52-61)

*Indicates an "off the shelf" commercial transducer. This is followed by a coded identification of the vendor and the vendor model number if known.

Vendor Code

WKWianco Engineering Co.BLHBaldwin-Lima HamiltonMASSAMassa Laboratories, Inc.TThermo Electric Co., Inc.R-DRocketdyneWAUGHWaugh Engineering Co.

Indicates the transducer is the same one as that used for the measurement number immediately following this symbol.

VII. TRANSDUCER SERIAL NUMBER (Col. 62-66)

VIII. TRANSDUCER LOCATION (Col 67-70)

Station Number (Col. 67-70)

Location by station number to the nearest inch.

Quadrant Number (Col. 71)

- 1 Quadrant I
- 2 Quadrant II
- 3 Quadrant : I
- 4 Quadrant IV
- X XX Axis
- Y YY Axis

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FOR LANDLINE AND CAPTIVE TEST

IX. TYPE OF RECORDER (Col. 30-34)

- A AM tape
- D Sanborn type recorder
- E Eput meter, counter
- F FM tape
- G Esterline-Angus-Type AW Graphic Recorder
- L Panel Light
- M Meter
- O Oscillograph (CEC)
- P Printer
- R EA Sequence Recorder
- S Strip chart (Brown, Speedomax)

FOR TELEMETERING ONLY

X. MEASUREMENT CHANNEL ASSIGNMENTS (Col. 30-34, on TLM only)

Telemeter transmitter number (Col. 30)

Subcarrier channel numbers (Col. 31-32)

1-13, A. C. E

Pin number (Col. 33-34)

Pin number if commutated in telemeter package

Pin number 1 thru 60

TYPE OF MEASUREMENT (Col. 76, on TLM only)

- P Primary An original measurement with one transducer, the output of which is sent to only one telemetering package.
- M Multiple When a measurement is picked up by one transducer but gent over two or more telemetering packages the original measurement is considered primary and the repeated ones considered nultiple.

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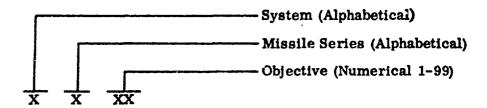
SPECIAL CODING (Col. 76, on TLM only)

C Installation Drawing/Wiring Diagram

XI. OBJECTIVE/INSTRUMENTATION COMPOSITE

A. Chiective Coding

 The coding system for test objectives has been developed to provide a rapid means of identification and handling of a large number of objectives. Coded objectives are listed along with the instrumentation required for accomplishment.



2. Letters used to identify the system are identical to those used to identify the system described in Section II of the code key.

B. Standard Objective Terminology

Each objective will contain one of the following five key terms. These terms defined below will establish a standard datum for uniform interpretation of test objectives.

- 1. <u>DEMONSTRATE (DEM)</u> denotes the occurrence of an action or an event during a test. The accomplishment of this type objective requires a qualitative answer. The answer will be derived through the relation of this action or event to some other known information or occurrence. This category of objective implies a minimum of airborne instrumentation, and/or that the information be obtained external to the missile.
- 2. DETERMINE (DET) denotes the measuring of performance of any unit or system. This category implies the quantitative investigation of overall operation which includes, generally, instrumentation for measuring basic inputs and outputs of the unit or system. The information obtained should indicate to what extent the system is operating as designed. The instrumentation

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should allow performance deficiencies to be isolated to either the system or to the system inputs.

3. EVALUATE (EVAL) denotes the measuring of performance of any unit or system as well as the performance and/or inter-action of its sections or subsystems that are under investigation.

The accomplishment of objectives of this type requires quantitative data on the performance of both unit or system and its sections or subsystems. Instrumentation for this category generally includes measuring basic inputs and outputs of the unit or system as well as basic inputs and outputs of its sections or subsystems. The performance levels of the sections or subsystems will then be analyzed for their contribution toward performance of the unit or system. This category will provide the most detailed information of any of these categories.

- 4. OBTAIN DATA (OBTN) denotes gathering engineering information which is to be measured to augment the general knowledge required in the development of the over-all weapon system. This category may also be used for supplemental investigations such as environmental studies, ascertaining k factors, ground equipment studies, etc. The degree of instrumentation is not implied by this definition; individual objectives will indicate extent of instrumentation required.
- 5. <u>ESTABLISH (ESTB)</u> denotes gathering engineering information for the development of ground procedures and operating techniques. Objectives in this category are not necessarily dependent on analytic studies.

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		<u>A</u>		B
	A/B	AIRBORNE	В-О	BOIL OFF
	A/P	AUTOFILOT	B & S	BOOSTER & SUSTAINER
_ +	AC	ALTERNATING CURRENT	BAT	BATTERY
(\mathbf{p})	ACA, AA	ACCUSTICA	BCN	BEACON
	ACCEL	ACCELERATION	BGG	BOOSTER GAS
	ACCRY	ACCESSORY		GENERATOR
	ACLMTR	ACCELEROMETER	BHD	BULKHEAD
	ACTR	ACTUATOR	BK	BREAK
	ACUM	ACCUMULATOR	BKHS	BLOCKHOUSE
	ADAPT	ADAPTER	BLWS	BELLOWS
n.i	ADF	AERONUTRONICS DIV. OF FORD	BRG	BEARING
D	AEDC	ARNOLD ENGINEERING	BRKT	BRACKET
		DEVELOPMENT CENTER	BSTR	BOOSTER
	AFCRC	AIR FORCE CAMBRIDGE	BTL	BOTTLE
		RESEARCH CENTER	BYP	BYPASS
D	AFSWC	AIR FORCE SPECIAL		
•		WEAPON CENTER		<u>C</u>
	\GC	AUTOMATIC GAIN CONTROL		
D	\ I G	ALL INERTIAL GUIDANCE	C	HUNDREDS
91	ALTR	ALTERNATE	C-O, COF	CUT OFF
	MB	AMBIENT	CALIB	CALIBRATE
D	MPL	AMPLIFIER	CALOR	CALORIMETER
21	\NG	ANGLE	СН	CHILL
	INT	ANTENNA	CHAN	CHANNEL
	\PS	ACCESSORY POWER	CHM	CHAMBER
i		SUPPLY	CKT	CIRCUIT
D	SC	ANALOG SIGNAL CONVERTER	CLSD	CLOSED
1	SSY	ASSEMBLY	CLSG	CLOSING
D	.TT	ALITUDE	CMD	COMMAND
	CUD	AUDIO	CMPST	COMPOSITE
	'UX	AUXILIARY	COMP	COMBUSTION
	.VG	AVERAGE	COMPT	COMPARTMENT
	.X	AXIS	CONV	CONVERTER
	. Z	AZIMUTH	CTL	CONTROL
		_	CTR	CENTER
		<u>B</u>	CY	CYCLE
		TO OCCUPED	CYL	CYLINDER
_ 1	/**	BOOSTER		
,D	/U	BACKUP		
	1	BOOSTER #1		
	2	DOOSTER #2		

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	<u>D</u>		<u>_G</u>	
DC	DIRECT CURRENT	GM	GRAM	D
DCDR	DECODER	GPM	GALLONS PER MINUTE	,
DEFLN	DEFLECTION	GND	GROUND	
DEFLR	DEFIFCTOR	GN_2	GASEOUS NITROGEN	
DEMOD	DEMODULATOR	GO_2^2	GASEGUS OXYGEN	
DESTR	DESTRUCTOR	-		
DG	DISPLACEMENT GYRO		H	
DI	DISCRETE INTEGRATOR		copied that the	
DIS	DISCRETE	H/D	HOLDDOWN	
DISCH	DISCHARGE	ĤΕ	HELIUM	
DISCON	DISCONNECT	HI	HIGH	
DISPL	DISPLACEMENT	HORZ	HORIZONTAL	
DN	DOWN	HPD	HYDRAULIC PUMP	
DO	PROP OUT		DISCHARGE	1
DP	DIFFERENTIAL PRESSURE	HFU	HYDRAULIC PUMPING UNIT	İ
		HS	HYDRAULIC SUPPLY	D
	E	HSP	HELIUM STORAGE PANEL	1
	·	HT	HEAT	
EMER	EMERGENCY	HTR	HEATER	
ENG	ENGINE	CYH	HYDRAULIC	
ETP	ENGINE TEST PANEL			
EXHST	EXHAUST		<u>I</u>	
EXT	EXTERNAL			
		IF	INTERMEDIATE FREQUENC	Y
	F	IGN	IGNITOR OR IGNITION	
	**************************************	INFO	INFORMATION	
F, FUL	FUEL	INJ	INJECTOR OR INJECTION	(D)
FAIL	FAILURE	INL.	INLET '	ı
FP	FEEDBACK	INST	INSTRUMENTATION	1
FIL	FILAMENI	INSUL	INSULATION	D
FIN	FINE	INT	INTERNAL	•
FREQ	FREQUENCY	INVTR	INVERTER	ŝ
FRG	FAIRING			D
FV	FUEL VALVE		J	
FWD	FORWARD			
		JET	JETTISON	
	G	JUNCT	JUNCTION	
GEN	GENERATOR		K	a
GG	GAS GENERATOR			•
-		K	THOUSANDS	

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		L.		<u>P</u>
D	L, LCHR	TAUNCHER	P	PRESSURE
	LKN	LOCKIN	PB	PULSE BEACON
	LN	LINE	PB-IP	PULSE BEACON-IMPACT
	LNG	LONG	PC	PREDICTOR
į	LN ₂	LIQUID NITROGEN	PCH	PITCH
D	LONG	LONGITUDINAL	PCT	PERCENT
	LO ₂	LIQUID OXYGEN	PCU	PRESSURIZATION CONTROL
:	LT	LIGHT		UNIT
D	LUS	LUBE	PG, PRGR	PROGRAMMER
4	LVL	LEVEL	PH	PHASE
			PNEU	PNEUMATIC
		<u>M</u>	POS	POSITION OR POSITIOMER
1			PPS	PULSES PER SECOND
0	MAG	MAGNETRON	PRESD	PRESSURIZED
•	MAN	MANUAL	PRESS	PRESSURIZATION
	MAN	MANIFOLD	PRG	PURGE
	MANO	MANOMETER	PROP	PROPELLANT
	MC	MEGACYCLES	PROP VLVS	PROPELLANT VALVES
	MSL	MISSILE	PS	POUNDS PER SECOND
	MEW	MICROSWITCH	PS	POWER SUPPLY
	MULT	MULTIPLIER	$\mathbf{p}_{\mathbf{U}}$	FROPELLANT UTILIZATION
			PUV	PROPELLANT UTILIZATION
		N		VALVE
			PWR	POWER
	NAA	NORTH AMERICAN	PWRSUP	POWER SUPPLY
		AVIATION		
D	NO.	NUMBER		Q
D			ନ	GE YAW RATE
		<u>o</u>	QUAD	QUADRANT
D	OP	OPTICAL PROBE,		R
•		OUTPUT, OPERATIONAL		
ı	OPN	OPEN	R	ROLL
a	OPER	OPERATIONAL	RAD, RD	RADIAL
1	ORFC	ORIFICE	RB	RATE BEACON
1	OSC	OSCILLATOR	RB-IP	RATE BEACON-IMPACT
D	OTP	OUTPUT		PREDICTOR
•	OUTBR	OUTBOARD	RCC	ROUGH COMBUSTION CUT-OFF

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	R		<u>T</u>	!
REDNT	REDUNDANT	T/C	THERMOCOUPLE	
REF	REFERENCE	TAB	TABULATION	(D
REG	REGULATOR	TACH	TACHOMETER	' ``
REGS	REGULATORS	TANG	TANGENTIAL	,
REL	RELAY	TCC	TEST CONDUCTOR'S	D
RESVR	RESERVOIR		CONSOLE	'
RF	RADIO FREQUENCY	TEMP	TEMPERATURE	
RG	RATE GYRO	THR	THRUST	
RNG	RANGE	TK	TANK	:
RSC	RANGE SAFETY	TLM	TELEMETER	
	COMMAND	TMR	TIMER	
RV	RE-ENTRY VEHICLE	TOPG,	TOPPING	(D)
	(NOSECONE)	TPNG		, -
		TOT	TOTAL	
	<u>s</u>	TRG	TRAJECTORY	
			••	
S	SUSTAINER		<u>u</u>	D
SA	SERVO AMPLIFIER			a
SA SECT	SERVO AMPLIFIER SECTION	U	UPPER	a ,
SA SECT SEP	SERVO AMPLIFIER SECTION SEPARATION	UMBL	UPPER UMBILICAL	1
SA SECT SEP SEQ	SERVO AMPLIFIER SECTION SEPARATION SEQUENCE	_	UPPER	1
SA SECT SEP	SERVO AMPLIFIER SECTION SEPARATION SEQUENCE SUSTAINER GAS GENERATOR	UMBL	UPPER UMBILICAL UPPER	1
SA SECT SEP SEQ SGG SHLD	SERVO AMPLIFIER SECTION SEPARATION SEQUENCE SUSTAINER GAS GENERATOR SHIELD	UMBL	UPPER UMBILICAL	1
SA SECT SEP SEQ SGG	SERVO AMPLIFIER SECTION SEPARATION SEQUENCE SUSTAINER GAS GENERATOR SHIELD SIGNAL	UMBL UP	UPPER UMBILICAL UPPER V	1
SA SECT SEP SEQ SGG SHLD	SERVO AMPLIFIER SECTION SEPARATION SEQUENCE SUSTAINER GAS GENERATOR SHIELD	UMBL UP V1	UPPER UMBILICAL UPPER V VERNIER ENGINE #1	1
SA SECT SEP SEQ SGG SHLD SIG	SERVO AMPLIFIER SECTION SEPARATION SEQUENCE SUSTAINER GAS GENERATOR SHIELD SIGNAL	UMBL UP V1 V2	UPPER UMBILICAL UPPER V VERNIER ENGINE #1 VERNIER ENGINE #2	1
SA SECT SEP SEQ SGG SHLD SIG SNERS	SERVO AMPLIFIER SECTION SEPARATION SEQUENCE SUSTAINER GAS GENERATOR SHIELD SIGNAL SENSORS	UMBL UP V1 V2 VDC	UPPER UMBILICAL UPPER V VERNIER ENGINE #1 VERNIER ENGINE #2 VOLTS DIRECT CURRENT	1
SA SECT SEP SEQ SGG SHLD SIG SNERS SNERS	SERVO AMPLIFIER SECTION SEPARATION SEQUENCE SUSTAINER GAS GENERATOR SHIELD SIGNAL SENSORS SENSOR	UMBL UP V1 V2 VDC VEL	UPPER UMBILICAL UPPER V VERNIER ENGINE #1 VERNIER ENGINE #2 VOLTS DIRECT CURRENT VELOCITY	1
SA SECT SEP SEQ SGG SHLD SIG SNERS SNERS SNSR	SERVO AMPLIFIER SECTION SEPARATION SEQUENCE SUSTAINER GAS GENERATOR SHIELD SIGNAL SENSORS SENSOR SOLENOID	UMBL UP V1 V2 VDC VEL VERN	UPPER UMBILICAL UPPER V VERNIER ENGINE #1 VERNIER ENGINE #2 VOLTS DIRECT CURRENT VELOCITY VERNIER	, D
SA SECT SEP SEQ SGG SHLD SIG SNERS SNERS SNSR SOL SRV VLV	SERVO AMPLIFIER SECTION SEPARATION SEQUENCE SUSTAINER GAS GENERATOR SHIE LD SIGNAL SENSORS SENSOR SOLENOID SERVOVALVE	UMBL UP V1 V2 VDC VEL VERN VERT	UPPER UMBILICAL UPPER V VERNIER ENGINE #1 VERNIER ENGINE #2 VOLTS DIRECT CURRENT VELOCITY VERNIER VERNIER	1
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SA SECT SEP SEQ SGG SHLD SIG SNERS SNERS SNSR SOL SRV VLV STA STP STRUC	SERVO AMPLIFIER SECTION SEPARATION SEQUENCE SUSTAINER GAS GENERATOR SHIELD SIGNAL SENSORS SENSOR SOLENOID SERVOVALVE STATION STOP STRUCTURE	UMBL UP V1 V2 VDC VEL VERN VERT VIBN	UPPER UMBILICAL UPPER V VERNIER ENGINE #1 VERNIER ENGINE #2 VOLTS DIRECT CURRENT VELOCITY VERNIER VERNIER VERTICAL VIBRATION	, D

SYSTEM

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GENERAL DYNAMICS/ASTRONAUTICS

15 MAY 1961

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15 MAY 1961

E SERIES SEQ PEN LIST 06-08-61

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,	5	50	Ε	DESCRIPTION	Қ Р	PEN	1	^
				TIMING PIP				
				SPARE		PEN	2	
:	5	1372	X	PRESSURIZE VERN TANK	600P110L	PEN	3	11.13
	P	1161	X	TCC START SWITCH	P2388	PEN	4	11,13
Í	P :	1549	X	IGNITION START	201U1P100J	PEN	5	11,13
1	Ρ :	1545	X	S IGN STAGE CONTROL	2010191018	PEN	6	11,13
ı	P	1544	X	VERNIER CONTROL	201U1P100A	PEN	7	11.13
l	p :	1156	х	B1 TBN OVRSPEED TRIP	600J114F	PEN	8	11.13
1	P .	1157	X	B2 T3N OVRSPEED TRIP	600J114H	PEN	9	11,13
,	P :	1588	X	S TBN OVERSPEED TRIP	201U3P1E	PEN	10	11,13
6	> ;	1547	X	B1 CUTOFF RELAY	201U1P100D	PEN	11	11.13
ł	P	1546	X	B2 CUTOFF RELAY	201U1P100C	PEN	12	11,13
f	o :	1347	X	S CUTOFF RELAY	201U1P100F	PEN	11	11,13
ş	>	1785	X	B SECONDARY SHUTDOWN	201U1P100T	PEN	14	13
í	P	1785	X	B SECONDARY SHUTDOWN	201U1P100T#	PEN	14	11
Į	P	1164	x	TCC ENGINE COF SW	P23B12	PEN	15	11
ł	Р	1164	x	TCC ENGINE COF SW	P23827	PEN	15	23
	Ρ	1155	x	OBSERVER CUTOFF	P8A30	PEN	16	1 ,13
	P	1548	X	COMPLETE COF RELY	2^1U1P100E*	PEN	17	11
I	P .	1548	X	COMPLETE COF RELY	201U1P101V*	PEN	17	13
!	ρ	1598	X	VERNIER CUTOFF RELAY	201U1P100E	PEN	18	11.13
				SPARE		PEN	19	

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REPORT NO. AZC-27-059

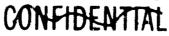
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15 MAY 1961

E SERIES SEQ PEN LIST 06-08-61

		SPARE		PEN	20	
		TIMING PIP		PEN	21	
M	1090 x	MSL ONE INCH MOTION	P948D	PEN	22	11,13
N	1335 x	SLG CH LOX DISCH VLV	PloiL	PEN	23	11,13
N	1336 x	SLG CH LOX DISCH VLV	200P101P	PĒN	24	11,13
N	1337 X	SLG CH LOX INLET VLV	200P101T	PEN	25	11.13
N	1338 X	SLG CH LN2 INLET VLV	200P101R	PEN	26	11,13
N	1339 X	SLG CH GN2 INLET VLV	200P101N	PEN	27	11.13
S	1372 x	PRESSURIZE VERN TANK	600P110L	PEN	28	11
S	1372 X	PRESSURIZE VERN TANK	600U1P3J	PEN	28	13
\$	1373 X	BOOSTER CUTOFF	600U1P3C	PEN	29	11.13
5	1374 X	SUSTAINER CUTOFF	600U1P3B	PEN	30	11,13
5	1376 x	VERNIER CUTOFF	600U1P3A	PEN	31	11,13
P	1225 x	ENGINE CONTROL READY	201U1P102A	PEN	32	11,13
P	1226 X	PNEUMATICS CUTOFF	TB102-30	PEN	33	11,13
		SPARE		PEN	34	
		SPARE		PEN	35	
		SPARE		PEN	36	
P	1688 X	VERNIER ENG PURGE	Pliw*	PEN	37	11,13
P	1227 X	LOX DOME PURGE	P11K#	PEN	38	11,13
P	1228 X	IGNITER FUEL PURGE	PllV*	PEN	39	11.13
		SPARE		PEN	40	
		TIMING PIP		PEN	41	

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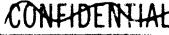
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E SERIES SEQ PEN LIST 06-08-61

S	1235	X	PROGRAMMER RUN TIME	TB301-187	PEN	42	11,13
S	1370	X	STAGING	600J101K	PEN	43	11
S	1370	X	STAGING	600U1P4AC	PEN	43	13
5	1371	X	BOOSTER JETTISON	600U1P3V	PEN	44	11.13
Р	1231	x	LOX 100% SLUG COM	203U4P101A	PEN	45	11,13
Р	1229	×	LOX HIGH TOPPING	203U4P101B	PEN	46	11.13
P	1230	x	LOX LOW TOPPING	203U4P101C	PEN	47	11,13
S	1375	X	VSHPS BACKUP SIGNAL	600U1P4P#	PEN	48	11,13
			SPARE		PEN	49	
\$	1377	x	EJECT RV UMBILICAL	TB201-31	PEN	50	11.13
S	1378	X	RV JETTISUN	600U1P3U	PEN	51	11,13
5	1379	X	FIRE RETRO ROCKETS	600U1P3N	PEN	52	11,13
			SPARE		PEN	53	
N	1335	X	SLG CH LOX DISCH VLV	200P101K	PEN	54	11,13
N	1932	X	LOX TOPPING VLV CLSD	200P101E	PEN	5 5	11.13
N	1933	X	LOX TOPS VEV OPEN	200P101C	PEN	56	11.13
N	1357	X	SLG CH LOX INLET VLV	200P1015	PEN	57	11.13
N	1336	x	SLG CH LOX VENT VLV	200P101C	PEN	58	1,13
N	1356	X	SEG CH LOX LOW LEVEL	200P101V	PEN	59	11.13
N	1979	X	PRESS VLV CLOSED	200P101M	PEN	60	11,13
			TIMING PIP		PEN	61	
IJ	1207	x	FUEL 95% PRI CTL	203U4P101X	PEN	62	11.13
U	1206	X	FUEL 95% SEC CTL	203U4P101F*	PEN	63	11.12

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υ	1205	X	FUEL 100% PRI CTL	203U4P101G*	PEN	64	11,13
U	1204	x	FUEL 100% SEC CTL	203U4P101Y*	PEN	65	13
U	1204	X	FUEL 100% SEC CTL	203U4P1C1Y	PEN	65	11
U	1203	X	LOX 95% RAPID LOAD-1	203U4P103E	PEN	66	11
U	1203	X	LOX 95% RAPID LOAD-1	203U4P103H	PEN	66	13
U	1211	X	LOX 95% RAPID LOAD-2	203U4P103F	PEN	67	11
U	1211	X	LOX 95% RAPID LOAD-2	203U4P103G	PEN	67	13
U	1202	X	LOX TOPG LO CTL-1	203U4P103G	PEN	68	11
U	1202	X	LOX TOPG LO CTL-1	203U4P103F	PEN	68	13
U	3.210	X	LOX TOPG LO CTL-2	203U4P103H	PEN	69	11
IJ	1210	X	LOX TOPG LO CTL-2	203U4P103E	PEN	69	13
U	1201	X	LOX TOPG HI CTL-1	203U4P103D	PEN	70	11,13
U	1209	X	LOX TOPG HI CTL-2	203U4P165C	PEN	71	11,13
U	1200	X	LOX 100% SLUG COF-1	203U4P103B	PEN	72	11,13
U	1208	X	LOX 100% SLUG COF-2	203U4P103A	PEN	73	11-13
			SPARE		PEN	74	
Н	1187	X	B OIL EVACUATION	TB10-6640	PEN	74	13
			SPARE		PEN	75	
Н	1188	X	S OIL EVACUATION	TB10-6641	PEN	75	13
P	1192	X	81 ROUGH COMB CGF	TB98-1Z32	PEN	76	11,13
P	1193	X	B2 ROUGH COMB COF	T898-1Z33	PEN	77	11,13
۶	1438	X	S ROUGH COMB COF	1898-1234	PEN	78	11,13
P	1975	×	B1 RCC BACK-UP RELAY	T898-1235	PEN	79	11.13

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15 MAY 1961

E SERIES SEQ PEN LIST 06-08-61

P 1976 X B2 RCC BACK-UP RELAY TB98-1236 PEN 80 11,13

*LOWER CASE LETTER

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CONVAIR

ASTRONAUTICS

GENERAL DINAMICS CORPORATION

TPL 2332 3 August 1960

ACT - SHEETING

To:

All Holders of Report AZC-27-059-3

'UG 8 1960

Prom:

T. M. Wooster - Test Planning

LIDNAKY

Subject: Instrumentation Configuration Report, Series E,

Article 3 (Revision A) dated 7 July 1960

The enclosed revision has been prepared to summarise all the instrumentation changes made since the publication of the original 3-8 Report.

It is recommended that this report be physically incorporated in the cack of Report AZG-27-059, replacing the superseded pages, in order that holders of the document may have a complete instrumentation configuration document for the E series under a single cover.

The replaced pages are to be destroyed in accordance with existing security regulations.

Instrumentation Flanning

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THE :WSB:prg

Distribution List Report AZC-27-059-3

NOTE: THIS NEWO TO BE DEVILOSSIED WHEN

DETACHED FROM CLASSIFIED DOCUMENT.

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WS-107A-1

INSTRUMENTATION CONFIGURATION

SERIES E ARTICLE 3

AMR

CONVAIR:

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PREPARED BY TEST PLANNING

COORDINATED BY 138 B

Test Planning

Chief-Field Test

Engineering

PORT AZC-27-059-3

GE NO. A

CONFIDENTIAL CONVAIR-ASTRONAUTICS

ULY 1960

REVISIONS

BATE	BY	CHARGE	PAGES LETTERO
July '60	WSB	ADDITIONS:	
		P1083B, P10846, P13498, P14390,	ALL TABS
		P14520, F14530, P10017, P1132P,	and Park to Section 1 and 1 and 1 and 1 and 1 and 1 and 1 and 1 and 1 and 1 and 1 and 1 and 1 and 1 and 1 and 1
		F1003F, P1004P, P155P, *184P, 2185P,	
		P188P, P1189P, P1190P, P277, P351r,	
		9473P, P1020T, P1151T, P1204T, P1205T,	(man), pangga selata teranda, hito per panggapan penggapan dalah dari belaga
		21437W, P1454W, P1455W, P1192X,	
		P1193%, P1438x, P1785x, 91208x,	
		U1209x, U1210x, U1211x	
		Reasons for Revision MAII Changes	4-1
7 July 160	MSB	DEI ETIORS:	
		P1279P, P1341P, P1473P, P413P, P420P	ALL TADS
	· ••••••••••••••••••••••••••••••••••••	WB TWO MRM. By	

S MATERIAL CONTAINS INFORMATION AFFECTING (ME NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS, TITLE U.S.C., SECTIONS 783 AND 784, THE IRAMSMISSION OF REVELATION OF WHICH IN ANY MANNER TO AN UNAUTHORIZED PENSON IS PROHIBITED BY LAW.

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7 JULY 1960

FOREWORD

This report has been published in accordance with contractual requirements as cited in Convair-Astronautics Report ZM-7-289. It describes the instrumentation released for Missile 3-E as of 30 July 1960.

Information presented here will be used by Air Force, Associate Contractors, Design, Operation, and Field Test Groups. Measurement modification will either originate in the Instrumentation Planning Group or will be submitted as a recommendation to this group.

A

CONFIDENTIAL REPORT NO. AZC-27-059-3 CONVAIR-ASTRONAUTICS PAGE NO. iii

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Telemetered Measurements by Channel	9-1	
Landline Instrumentation	10-1	

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15 March 1960

SUMMARY

The instrumentation configuration for this missile has been established through a study of program test objectives, systems analysis, and operating considerations. A discussion of missile instrumentation and associated characteristics has been summarized in Report AZC-27-059. For a detailed description of the various missile systems, test objectives, and general test program see Report AZC-27-008.

The specific measurements to be transmitted via telemeter have been tabulated and are listed in Sections 8 and 9 in terms of instrumentation system and telemeter channel assignments.

In addition to the telemetry, the landline instrumentation program for this missile has been included in this report in the form of a master tabulation of landline measurement characteristics, (Section 10).

To clarify specific measurements, instrumentation location schematics have been included in Report AZC-27-059, Section 7.

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7 JULY 1960

REASONS FOR REVISION "A" CHANGES

ľ. In order to gain data on the performance of the MA-3 turbopump ...be oil and pressurization systems during flight, 3 lube oil pressure measurements were switched from landline to telemetry.

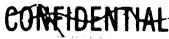
MEAS. NO.	DESCRIPTION	CHANNEL
DELETE:		
P1279P	B2 LO PR LUBE OIL MAN	
P1341P	S LUBE OIL MANIFOLD	
P1473P	B1 LO PR LUBE OIL MAN	
ADD:		
P279P	B2 LO PR LUBE OIL MAN	2 11.43
P341P	S LUBE OIL MANIFOLD	2.11.47
P473P	B1 LO PR LUBE OIL MAN	2.11.45

п. The turbopump speeds, RCC accelerometers and binary counter outputs will be recorded during FRF's to gain data on rough combustion and other thrust chamber and turbopump phenomena. The pump speeds and accelerometers will be record if on AM tape. Thrust chamber pressure and PCC counter outputs are to be recorded on oscillographs.

ADD:

P1083B	B2 PUMP SPEED
P1084B	B1 PUMP SPEED
P1349B	S PUMP SPEED
P1439O	S NAA RCC ACCEL
P1452O	B1 NAA RCC ACCEL
P1453O	B2 NAA RCC ACCEL
P1437W	S RCC BINARY COUNTER
P1454W	B1 RCC BINARY COUNTER

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MEAS. NO.	DESCRIPTION	CHANNEL
ADD:		
P1455W	B2 RCC BINARY COUNTER	
P185P	B1 TURBOPUMP GEAR BOX	2.11.49
P188P	B2 TURBOPUMP GEAR BOX	2.11.51

III. In order to assure that the orifices have been properly sized in the booster gas generator LO₂ feed lines:

ADD:

P1001P	B1 LO, PUMP INLET	
P1002P	B1 FUEL PUMP INLET	
P1003P	B2 LO ₂ PUMP INLET	
P1004P	B2 FUEL PUMP INLET	
P1020T	B1 LO_2 PUMP INLET	
P155P	B1 GAS GEN COMBUSTOR	1.12.23
P184P	B2 GAS GEN COMBUSTOR	1.12.33
P1151T	FUEL TK @ STA 1043	
DELETE:		

DELETE:

P419P	B1 GG LO ₂ INJ MAN
P420T	${\tt B2~GG~LO_2~INJ~MAN}$

IV. To allow evaluation of revised LO₂ slug system, 2 temperature and 2 pressure measurements have been added:

ADD:

P1189P	B1 GAS GEN LO ₂ IN
P1190P	$B2 GAS GEN LO_2 IN$
P1204T	BI TOPPING LINE OUT
P1205T	B2 TOPPING LINE OUT

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V. IBM difficulties make it desirable to assign different measurement numbers for the new CVA dual LO_2 tanking probes.

MEAS. NO. DESCRIPTION

ADD:

U.1208X LO₂ 100% SLUG COF-2

U1209X LO₂ TOPG HI CTL-2

U1210X LO₂ TOPG LO CTL-2

U1211X LO₂ 95% RAPID LOAD-2

VI. The following rough combustion control cutoff signals will be monitored to a certain type and timing of shutdown for failure analysis purposes. Measurement P1785X was added to validate the booster secondary shutdown system timer:

ADD:

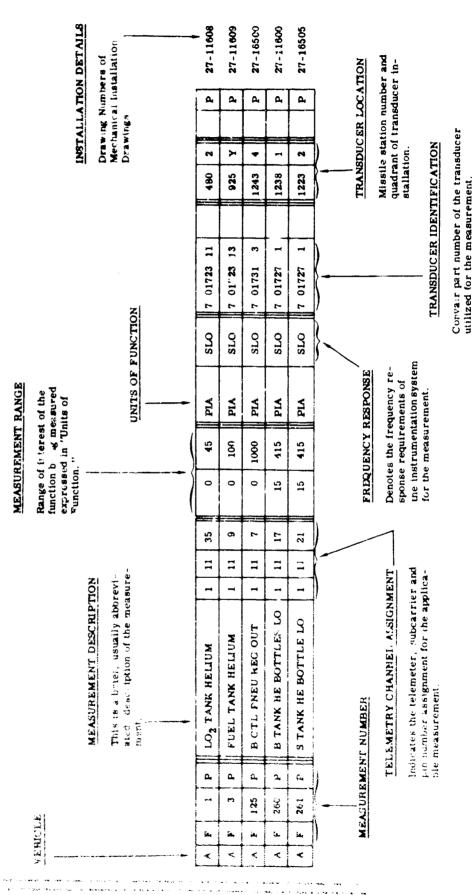
P1192X	B1 ROUGH COMB CUTOFF
P1193X	B2 ROUGH COMB CUTOFF
P1438X	S ROUGH COMB CUTOFF
P1785X	B SECONDARY SHUTDOWN

SECTION 8

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MISSILE INSTRIMENTATION BY SYSTEM

The Missile Instrumentation Log presented in this section contains the latest available characteristics of the individual measurements. In additional, the telemetering channel assignments are included. Note that this section in listed by system.



NOTE: For a more detailed explanation of this format and a ley to abbreviations and coding see the IBM Code Key in the Summary report.

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REPORT NO. AZC-27-059-3A

SECTION 8

7 JULY 1960

The state of the s	MISSILE REPORT NO. DATE 07 JOL 60 PAGE														
DESCRIPTION	The Facilities and	SWING DERES NO	CO ACTATOR	LOW	SUACMENT BANGE HIGH		ACCURACT	OR PROUDENCY DO PROUCHOR	OF TRANSBUCER	34RIAL NO.	STATION NO.	QUADEANT	Ш	DRAWING NUMBERS	
A AIRFRAME			b)		12 17				1213 S4M141750 174041	e u	U N		n		
		-	-	₩		-	-					-	₩_		
A 744 I THRUST SECT LITE B		11	7	111	+	╫─	-		7 01709 1		1220	Г	Ш	1	
		1		1	1	\parallel			7 01709 :		1220	2	<u>P</u>	27-11733	
A 488 7 AMB F STG VLV Q3	1	11	15	M10	300	DGF		SLO	27 01287 3	14327	1174	3	р	27-11793	
A 638 T AFT SIDE A FRAME Q	1	11	13	MIO	300	DGF		SLO	27 01287	13051	1220	2	Р	27-11793	
A 639 T AMB JET RAIL QA	7		7	M100	7	DGF	1		{{ }	12691				27-11793	
A 640 T FWD SIDE A FRAME Q4	1-	Τ-:		M100		DGF	1		}	13071	1			27-11793	
4 642 T AMB NEAR B2 GG Q3	İ	\Box	1	M100		DGF			lt I	1275T 1270T	1		Π	27-11793 27-11794	
A 645 T AMB FWD B1 Q4				M100	1	DGF		SL	1	12667			Π	27-11794	
				 										2007	
D RANGE SAFETY SYSTEM				 	ļ										
D 1 V RSC CUTOFF OUTPUT	-											-	Н		
D 1 V RSC CUTOFF OUTPUT	1	13	5	0		Vnc		STP				-	P		
D 7 V #1 RSC RF INPUT/AGC	1	A	5		100K	VDC		SLO		172		\dashv	M		
		_								112			Р		
D 3 X RSC DESTRUCT OUTPUT	2	Ε	95	0	30	VDC		STP					Р		
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E ELECTRICAL POWER SY	-			ļ								#	H		
E 50 0 400 CYCLE AC PWRSUP	+	ļ		974	430	CDS						-			
TAN SIGGS AS FRANCE		_		210		\$P\$		LO				#	Р		
E 26 V HSL SYSTEMS INPUT		13	u	0	30	VDC	s	١٥		1			P		
E 51 V 400 CYCLE AC PHASE	1 1		13	1 1	11	VAC	s	ro				-	P		
E 53 V 400 CYCLE AC PHASE C	1	13	23	105	125	VAC	s	LO				-	- 7		
F PNEUMATIC SYSTEM	++	+	$-\parallel$			\vdash		$- \parallel \mid$			-+	₩	4		
3		1										#	1		
F 1 P LO3 TANK HEL JUM		3	93	Q	-92	PIA	s	LO	7 01723 11	3182	484 2			27-11679	
F 3 P FUEL TANK HELIUM	2 1	3	37	0	100	PIA	- 1	111	7 01723 12	111	1	Ш	7	27-11683	
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1 1	-		T	LO2 PRESS REG INLET	7-	1	-		3000	111					1187		Ш	1
i I		1		S CTL HE BTL DISCH	T			111	3500						1213		Ш	7
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F	24	6	9	B TANK HE BOTTLES HE	1	12	53	Q	3500	PIA	SI	.0	7 01720 5	•	1187	1 1		
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F	11	5	T	LOZ PRESS REG IMLET	1	41	5	M200	200	DGF	St	٥.	7 01684 3	362R	1205	5	P	27-11682
F	14	6	7	LOZ PRESS ORFC IN	1	11	11	0	500	DGF	Şı.	او.	7 01684 3	R115	1121	3	P	27-11732
F	24	?	T	B TANK HE BOTTLES	1	11	35	M400	M250	DGF	ŞĻ	.o	7 01633 5	161	1221	4	P	27-11682
F	29	0	1	S CTL HE BOTTLE	1	:1	41	M100	100	DGF	Sı	ار.	7 01633 7	_11L	1235	2	Р	27-11650
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_ [G	50	•	5	MOD 111 MAGNETRON	1	11	7	0	0.9	MA	SL	0				-	P	
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G	58	2 1	-++	HOD III RB RT OUTPUT	1	11	3	0	15	E	SL	•₩				-	Ρ	
G	50	-	,	MOD III PB AGC	-	-				-	 - -	$- \parallel$				$+\parallel$	-	
G		·	-11	MOD III RB AGC NO. 1	1		17	U	H4.8	VDC	SL	-##				\dashv	P	
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T				I	ACLE Z AXIS	1	C	1	7	M10	10	G		800	<u> </u>				- 4	ρ	4	
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i	1		1 1	11	PUTER Y AXIS	1	-5	13:	١.	610		_G_		800	! 				4	Р	4	
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1	7		4		•	7		1	•	10	11	12	13	14	15	10	17	
	SYSTEM	MEASUREME AT NUMBER	TYPE MEASUREMENT	DESCRIPTION	TELEMETER NO.	SUB-CARRIER NO	COMMUTATOR PIN NO.	RAI LOW	REMENT NGE HIGH	UNITS OF FUNCTION		BATE OF CT. ANGE OR PREQUENCY OF FUNCTION	TRANSDUCER	SEPIAL NO.	STATION NO.	QUADEAHT	CARD CODE	DRAWING NUMBERS
1	•	•	- [1		1	1	35 30	39 42	43 46	4 40	47 51	5253 5456565758 594041	., 4	67 ×	71	73	
	1	534) T	ANALOG SIG CONVERTER	1	12	13	4		ļ					#	$\perp \rfloor$	Р	
	1	53	7	COMPUTER	1	12	19			<u> </u>							Р	
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	ı	521	V	YAW STEERING SIG	2	_									1		p	
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	1			YAW STEERING SIG		ĺ	19	 	 	 					#	+-	M	
-	1			ROLL RESOLVER SIG		3	1	#		 	<u> </u>				#	+-	P	
-	I	521) V	ROLL RESOLVER SIG	2	11	15	#		₩					╂	+	M	
	1	53	V	PITCH RESOLVER SIG	2	4	-	 		<u>.</u>	<u> </u>	-			 -	44	Ρ	
-	1	53	V	PITCH RESOLVER SIG	2	11	17	 	ļ	 					 	4	M	
	1	540	v	CONTROL 115 PHASE B	1	12	11	0	130	VOC		SLO			║	Ţ	P	
	1	54	v	CONTROL M22.5 PSUP	1	12	21	0	25	VDC		SLO					ρ	
	1	54	v	COMPUTER MSO PSUP	3	9		M55	o	VDC							P	
	1	54	v	COMPUTER M16.5 PSUP	T		39			VDC	[SLO					Р	
	I			COMPUTER MIO PSUP		1	41			VDC	1	SLO					P	
· · · · +	I			COMPUTER 4 PSUP	\top	T-	43		1	VDC		SLO			#	+-	ρ	
	†			COMPUTER 38 PSUP	† <u> </u>	1	1			<u> </u>					#	+	11	
1	:		+		1		41	0	42	VDC	-	SLO			#	+	Р	
-	-		+-1	AZM RESOLVER SIG	+	8	†	 		 		40			#	+	Ρ	
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	1	52	x	VERN ENGINE COF SIG	ı	12	49	OFF	ON			STP					ρ	İ
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-	1		1 1	S ENGINE COF SIG	1	1		OFF	ON	1		STP			1	1	p	
1	1			S ENGINE COF SIG	†	9	1		1	#		BLP			 	+	Р	
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MISSILE INSTRUMENTATION LOG SHEET OF JUL 60 PAGE OF JU														
DESCRIPTION	TELEMETRE NO - SUB-CARRER NO - COMMUNICE FOR NO		UNITS OF FUNCTION	ACCURACY BATE OF CHANGE OR FREQUENCY OF FUNCTION	TRANSDUCER	MAIAL NO.	STATION MO	QUADRANT	CAMB CORE	B4AWING. NUMBZPS				
M 143 D BOOSTER SEPARATION	1 1	15 10 17 41	iN	4 4 7 1	7 01676 1	V19	***	74	P					
M 32 X CONAX VALVE COMMAND M 78 X STROBE LIGHT OCCUR	1	or i i	VDC	STP					P P					
M 84 X B STGG LATCH MSW Q1 M 85 X B STGG LATCH MSW Q2	3 8	OFF ON			87 44900 109 87 44900 109		1145			ı				
M 86 X 8 STGG LATCH MSW Q3 M 87 X 8 STGG LATCH MSW Q4	3 8	OFF ON			87 44900 109 87 44900 109		1145	3	ρ					
P PROPULSION SYSTEM														
P 798 A LOZ LINE AXIAL ACCEL	11111		G		27 01277 5		1111	1 1	1	27-11787				
P 83 B B2 PUMP SPEED		M60 60	į		27 01277 5		1111			27-11787 27-11722				
P 84 B B1 PUMP SPEED	2 2	5680 6400 9.9 11.2	RPM	SLO	27 01267 1 27 01264 3	17	1198 1234	4	Ρ	27-11721 27-11720				
P 528 D S MAIN FUEL VALVE	1 A 45		DEG	sLO					ρ	21-11-120				
P 529 D S MAIN LO2 VLV	1 12 37	0 90	DEG	SLO	NAA		1205	X	ρ	27-17564				
P 6 P S THRUST CHAMBER P 27 P VERNIER FUEL TANK	2 E 1 1 13 47	0 1000 C 1000	1	15 SLO	7 01731 5 7 01720 3	5154 2716	io di	- 11	1 . 1	27-11720 27-11651				
	1 A 33 1 A 35					1231 1184				27-11699 27-11699				
P 38 P B2 FUEL PUMP DISCH	1 13 13 2 E 23	. i N				2082R 6263	i . I	- 111		27-11651 27-11722				
P 56 P S LOZ PUMP INLET	2 E 21 1 13 17	0 150		1 11		4835 L1430				27-11721 27-11720				
P 60 P B1 THRUST CHAMBER	2 E 11 2 E 9	0 600	PIA	13	7 01731 1	4649 5269	1244	Y	Р	27-11684 27-11684				
P 91 P B1 LO2 INJ MANIFOLD P 92 P B2 LO2 INJ MANIFOLD		i i i	1 T			472 6 5057	i	- 111	•	27-11684 27-11684				

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VENCUE STATE STATE WEATUREMENT WUNDER	DESCRIPTION	FUECARRIER NO CONCURSOR NO CONCURSOR NO CONCURSOR NA NO	MEASUREMENT RAHOS LOW MIGH	UNITS OF FUNCTION	AATE OF CHANGE OR FREQUENCY OF FUNCTION	11	SERIAL MO	STATION NO		CARS COSE	BEAWING NUMBERI	
P 155 P	BI GAS GEN COMBUSTOR	1 12 23				7 01731 5	-	67 K	П	ρ		
	B2 GAS GEN COMBUSTOR				11	7 01731 5				ρ		
7	B1 TURBOPUMP GEARBOX					27 01243 5				P		
P. 188 P.	B2 TURBONUMP GEARBOX	2 11 51			SLO	27 01243 5				p		
P, 279 P	82 LO PE LUB OIL MAN	2 11 43	C 125	PIA	SLO	27 01243 9		1144	3	P		
P 330 P	S FUEL PUMP DISCH	2. E. 3	0 1500	PIA	15	7 01731 7	5735	1235	x	Р	27-11720	
P 337 P	SGG LOZ INJ MAN	1. A 31	0 1000	PIA	SLO	7 01731 5	_6272	1235	x	Р	27-11720	
P 341 P	S LUBE UIL MANIFOLD	2 11 47	0 1000	PIA	SLO	7 01731 7		1235	x	Р		
P 351 P	S LOZ INJ MANIFOLD	1 13 49	0 1000	PIA	SLO	7 01731 5	6208	1235	×	P	27-11720	
	BI LO PR LUS OIL MAN			PIA	SLO	27 01243 9		1173	1	Р		
P 474 P	V CTL PRESS REG OUT	1 A 15	0 1000	PIA	SLO	7 01720 1	4371	1208	Y	P	27-11651	
		+ + - +							H	Н		
	S LOZ PUMP INLET		M300 M270			7 01649 11				П	27-11720	1
			M100 300	1			1280T			П	27-11793	· .
<u> </u>	SGG COMBUSTOR	3 11 9				27 01247 3		1234		П	27-11720	
1-1-1-1	B1 GAS GEN COMBUSTOR B2 GAS GEN COMBUSTOR		!!!	1		27 01247 3		1210	- 111	П	27-11721	
	BZ GAS GEN COMBOSTON	3	0,1300	100	1320	2, 0124, 3	316	1210	╣	H	27-11722	
P 347 X	S CUTOFF RELAY	1 13 9	0 28	VDC	STP				╢	,		
h	B1 CUTOFF RELAY	1 7 5	#	VDC	STP				-##	P		
P 548 X	COMPLETE COF RELAY	1 13 5	0 28	VDC	STP				╢	P		
is	AUTOPILOT SYSTEM											
5 61 D	ROLL DISPL GYRO SIG	1 A 9	M3 3	DEG	5		14			وا		
S 62 D	PITCH DISPL GYRO SIG	1 A 11	M3 3	DEG	5		14		1	<u> </u>		
5 63 D	YAW DISPL GYRO SIG	1 A 13	M3 3	DEG	5		14		1			
5 203 D	B1 PITCH ROLL	1 7	M5 5	DEG	10	7 01680 7	969	1212	vIII!	2		
5 203 D	B1 PITCH ROLL	2 11 7	M5 5	DEG	10	7 01680 7	969	1212	<u>, </u>		27-11721	
	AND THE RESERVE OF THE PROPERTY OF THE PROPERT	2 E 15		DEG	10	7 01680 7	720	1212	<u>/ </u>	믹	27-11722	
5 205 0	francis and the second of the second	1 6	· manage	DEG	10	7 01680 7	963	1212	*#	4		
d 5 205 D	,	2 11 5		DEG	10	7 01680 7		1212	111	7	27-11721	
5 206 0	B2 YAW	2 € 19	M5 5	DEG	10	7 01680 7	716	1212	1	4	27-11722	
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WENCH	SYSTEM	MEASUREMENT HUMBER	TYPE MEASUREMENT	DESCRIPTION	TELEMETER NO	SUB-CARRIER NO	COMMUTATOR PIN NO		UREMENT ANG2 HIGH	UNITS OF FUNCTION	ACCURACY	RATE OF CHANGE OR FREQUENCY OF FUNCTION	TYPE OF TRANSDUCER	SERIAL NO	STATION NO.	QUADEANT	CARD CODE	DRAWIF
1	•	5 (•	10 29	10	31 32	1111	35 3)) 9 42	1) 4	4 49	47 51	5253 5455545754 574041	12 44	47 70	71	73	
	5	222	D	V1 PITCH	2	Ε	7		5 C	DEG	<u> </u>	10	7 01444 1	07667	1123	4	Р	27-11699
	s	223	0	V2 PITCH	2	Ε	5	ļ C	50	DEG	ļ	10	7 01414 1	07700	1123	2	P	27-11699
	5	233	D	V1 YAW ROLL	2	ε	13	M70	70	DEG	-	10	27 01205 1	75	1129	4	Ρ	27-11699
	5	234	D	V2 YAW ROLL	2	Ε	17	M70	70	DEG		10	27 01205 1	69	1129	2	Р	27-11699
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SECTION 8

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MISSILE INSTRUMENTATION LOG SHEET

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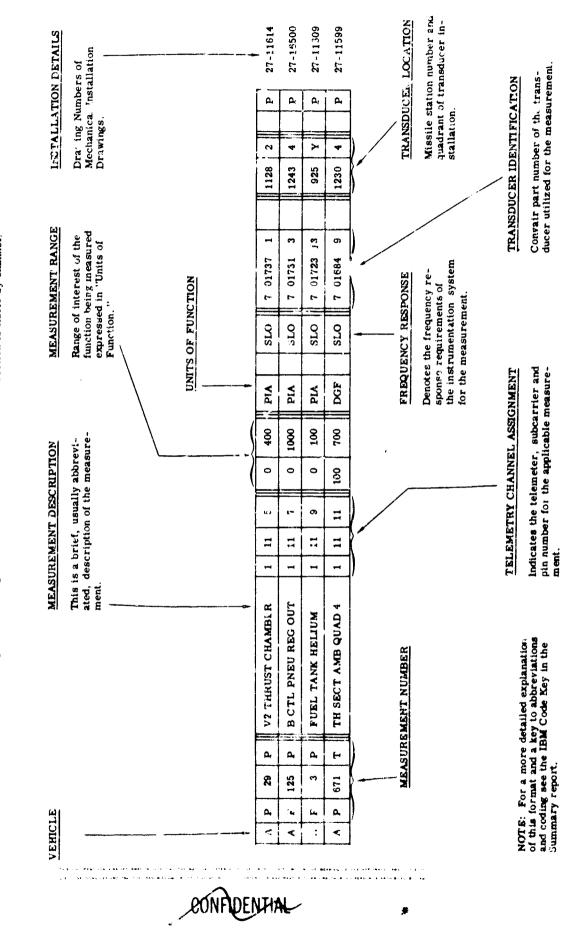
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CONVAIR-ASTRONAUTICS

SECTION 9

MISSILE LISTRUMENTATION BY CHANNEL

The Missile Instrumentation Log presented in this section contains the latest available characteristics of the individual measurements. In addition, the telemetering channel assignments are included. Note that this section is listed by channel.



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REPORT NO. AZC-27-059-3A

SECTION 9

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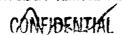
SECTION 9

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CONVAIR-ASTRONAUTICS

MISSILE INSTRUMENTATION LOG SHEET CONFIDENTIAL

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SECTION 9

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MISSILE INSTRUMENTATION LOG SHEET
REPORT NO AZC-27-059"3

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CONFIDENTIAL CONVAIR-ASTRONAUTICS

REPORT NO. AZC-27-059-3A

SECTION 9

7 JULY 1980

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CONVAIR-ASTRONAUTICS

SECTION 9

7 JULY 1960

MISSILE INSTRUMENTATION LOG SHEET

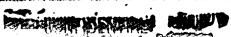
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SECTION 9

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CONVAIR-ASTRONAUTICS

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SECTION 6



CONVAIR-ASTRONAUTICS

REPORT NO. AZC-27-059-3A

SECTION 9

7 JULY 1960

MISSILE .INSTRUMENTATION LOG SHEET

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DESCRIPTION	TELEMETER NO.	SUB-CARRIER NO	1	LOV	1	UNITS OF FUNCTION	ACCULACY ::	AATE OF CHANGE OF PREQUENCY ZO	TYPE OF TRANSDUCER	SERIAL NO	STATION NO.	QUADRAME	CARB CODE	URAWING NUMSEPS
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SECTION 9

CONVAIR-ASTRONAUTICS

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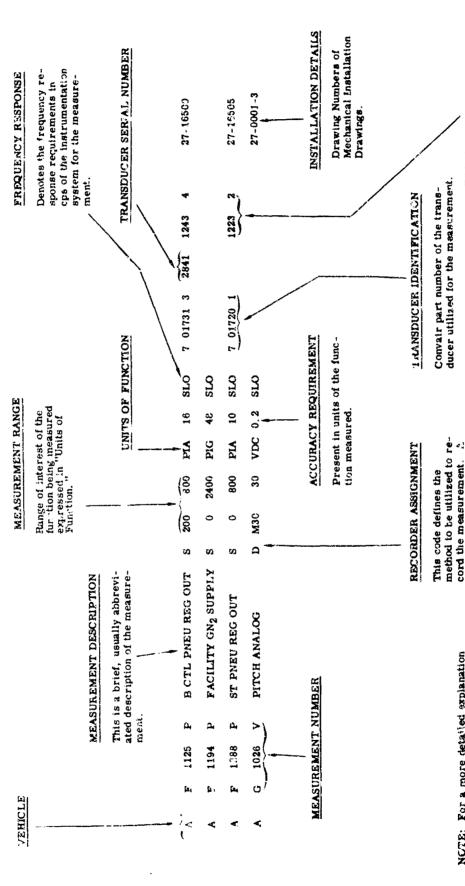
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SECTION 10 LANDLINE INSTRUMENTATION

The Landline Instrumentation presented in this nection contains the latest available characteristics of the individual measurements. In addition the type of recordings indicated.



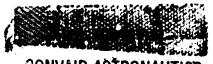
NCTE: For a more detailed explanation of this format and a key to abbreviations and coding see the IBM Code Key in the Summary report.

double letter here indicates

that this measurement will be recorded on two different types of recorders.

Missile station number and quadrant of transducer installation.

TRANSDUCER LOCATION



REPORT NO. AZC-27-059-3A

SECTION 10

7 JULY 1960

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MANC: 3 SYSTEM	MEASUREMEN	MINIM	DESCRIPTION	RECORDE	TRACK	CHANNEL		HEMENT	UNITS OF FUNCTION	ACCURACY	DA PREQUENCY OF PURCTION	OF TRANSOUCER	SEMAL NO.	STATION NO	QUADRARY	CARB COM	Brawing NUMBER
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D		-	RANGE SAFETY SYSTEM	• •	<u>.</u>		<u> </u>			ļ					\sqcup		
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D	M140	W	COMMAND #1 TOTAL		м		0	1000	HR							ρ	
i 1		1 11	COMMAND #2 TOTAL	1 3			0	4	111							ρ	
D	M150	W	COM #1 6 2 BATTERY	 	м		0	1000	HR				! 		Ц	ρ	
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E	M005	0	MISSILE INT PHASE A		М		396	404	CPS							Р	
		1 11	MISSILE EXT PHASE A		H		1	404								P	
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1	~ *						L		ļ								
E	4003	٧	MISSILE INTERNAL DC		M			_40	VDC							P	
E	4006	v	MISSILE INTERNAL AC		м		110	120	VAC		-					Ρ	
E	4022	٧.	MISSILE AC EXT # MSL	-	M			120								Р	
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-	1	1504	L	COMPUTER VELOCITY Z	+-	F		0	6K	F/S	4	10K				-	ρ	
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+	1	1601	 V	400 CPS REFERENCE	+	0		 	 	 	 	-			 -	-	P	
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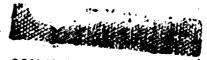
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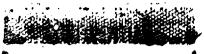
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CONVAIR-ASTRONAUTICS .

REPORT NO. AZC-27-059-3A

SECTION 10

7 JULY 1960

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SECTION 10

7 JULY 1960

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T. M. Wooster Instrumentation Planning

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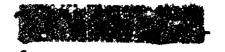
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ASTRONAUTICS CONVAIR GENERAL DYNAMICS CORPORATION

TPL: 2280 16 June 1960

To:

All Holders of Report AZC-27-059

T. M. Wooster - Test Planning

Subject: Instrumentation Configuration Report, Series E, Article 4,

dated 3 Yay 1960

The enclosed report has been prepared to reflect the instrumentation configuration (both landline and telemetry) of missile 4-5.

It is recommended that this report be physically incorporated in the back of Report AZC-27-059, in order that holders of the document may have a complete instrumentation configuration document for the B-R&D series under a single cover.

Instrumentation Planning

TW: SB:prg

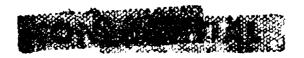
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REPORT NO AZC-27-059-4 BATE 3 May 1960

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WS-107A-1

INSTRUMENTATION CONTIGURATION

SERIES E ARTICLE 4

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COORDINATED BY 10.5.

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APPROVED BY.

frm H. R. Macdonald

Test Planning

CHECKED BY

T. M. Wooster Instrumentation

APPROVED BY

P. J. Lynch

Chief-Field Test

Engineering



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REFORT NO. AZC-27-059-4

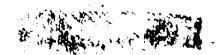
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16 August 1960



REVISIONS

NO.	BATE	84	CHANGE	PAGES AFFECTED
A	16 Aug 60	WS8	ADDITIONS:	
			EM109W, EM110W, F1194P, P1083B,	ALL TABS
			P1084B, F1349B, P1528D, P14390,	
			P14520, F14530, P18930, P18940,	
			P1001P, P1002P, P1003P, P1004P,	
			P155P, P184P, P185P, P188P, P1189P,	
			P1190P, P279P, PM430P, P341P, P473P,	
			P1020T, P1151T, P1204T, P1205T,	
			P1437W, P1454W, P1455W, P1897W,	
			P1898W, P1192X, P1193X, P1438X,	
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A	16 Aug 60	WSB	DELETIONS:	
			P1279P, P1341P, P419P, P420P, P1473P	ALL TABS
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16 August 1960

FOREWORD

This report has been published in accordance with contractual requirements as cited in Convair-Astronautics Report ZM-7-289. It describes the instrumentation released for Missile 4-E as of 16 August 1960.

(A)

Information presented here will be used by Air Force, Associate Contractors, Design, Operation, and Field Test Groups. Measurement modification will either originate in the Instrumentation Planning Group or will be submitted as a recommendation to this group.

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16 August 1960

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REASONS FOR REVISION "A" CHANGES	4-1	
TABULATIONS		
Telemetered Measurements by System	8	A
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Landline Instrumentation	10	



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3 May 1960

SUMMARY

The instrumentation for this missile has been established to support test objectives, systems analysis, and operating considerations. A discussion of missile instrumentation and associated characteristics has been summarized in Report AZC-27-059. For a detailed description of the various missile systems, test objectives, and general test program see Report AZC-27-043.

The specific measurements to be transmitted via telemeter have been tabulated and are listed in Sections 8 and 9 in terms of instrumentation system and telemeter channel assignments.

In addition to the telemetry, the landline instrumentation program for this missile has been included in this report in the form of a master tabulation of landline measurement characteristics, (Section 10). To clarify specific measurements, instrumentation location schematics have been included in Report AZC-27-059, Section 7.



16 August 1960

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REASONS FOR REVISION "A" CHANGES

I. In order to gain data on the performance of the MA-3 turbopump lube oil and pressurization systems during flight, 3 lube oil pressure measurements were switched from landline to telemetry.

MEAS NO.	DESCRIPTION	CHANNEL
DELETE:		
P1279P	B2 LO PR LUBE OIL MAN	
P1341P	S LUBE OIL MANIFOLD	
P1473P	B1 LG PR LUBE OIL MAN	
ADD:		
P279P	B2 LO PR LUBE OIL MAN	2.11.43
P341P	S LUTE OIL MANIFOLD	2.11.47
P473P	B1 LO PR LUPE OIL MAN	$2\cdot 11\cdot 45$

Ц. The turbopump speeds, RCC accelerometers and binary counter outputs will be recorded during FRF's to gain data on rough combustion and other thrust chamber and turbopump phenomena. The pump speeds, RCC accelerometers, and RCC counter outputs will be recorded on AM tape. Thrust chamber pressure will be recorded on oscillograph.

ADD:

P1083B	B2 PUMP SPEED	
P108B	B1 PUMP SPEED	
P1349B	S PUMP SPEED	
P1439O	S NAA RCC ACCEL	
P1452O	B1 NAA RCC ACCEL	
P1453O	B2 NAA RCC ACCEL	
P1437W	S RCC BINARY COUNTER	
P1454W	B1 RCC BINARY COUNTER	
P1455W	B2 RCC BINARY COUNTER	
P185P	B1 TURBOPUMP GEAR BOX	2 11 49
P188P	B2 TURBOPUMP GEAR BOX	2 11.51

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16 August 1960

III. In order to assure that the orifices have been properly sized in the booster gas generator LO₂ feed lines:

MEAS. NO.	DESCRIPTION	CHANNEL
ADD:		
P1001P	B1 LO ₂ PUMP INLET	
P1002P	B1 FUEL PUMP INLET	
P1003P	B2 LO, PUMP INLET	
P1004P	B2 FUEL PUMP INLET	
P1020T	B1 LO ₂ PUMP INLET	
P155P	B1 GAS GEN COMBUSTOR	$1\cdot 12\cdot 23$
P184P	B2 GAS GEN COMBUSTOR	1.12.33
P1151T	FUEL TK @ STA 1043	
DELETE:		
P419P	B1 GG LO ₂ INJ MAN	
P420T	B2 GG LO2 INJ MA	

IV. To allow evaluation or revised ${\rm LO}_2$ slug system. The temperature and 2 pressure measurements have been added:

ADD:

P1189P	B1 GAS GEN LO ₂ IN
P1190P	B2 GAS GEN LO2 IN
P1204T	BI TOPPING LINE OUT
P1205T	B2 TOPHING LINE OUT

V. IBM difficulties make it desirable to assign different measurement numbers for the new CVA dual LO_2 tanking probes.

ADD:

U1208X	LO ₂ 100% SLUG COF-2
U1209X	LO2 TOPG HI CTL-2
U1210X	LO ₂ TOPG LO CTL-2
U1211N	LO ₂ 25% RAPID LOAD-2

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16 August 1960

VI. The following rough combustion control cutoff signals will be monitored to ascertain type and timing of shutdown for failure analysis purposes. Measurement P1785X was added to validate the booster secondary shutdown system timer:

MEAS. NO.

DESCRIPTION

ADD:

P1192X	B1 ROUGH COMB CUTOFF
P1193X	B2 ROUGH COMB CUTOFF
P1438X	S ROUGH COMB CUTOFF
P1785X	B SECONDARY SHUTDOWN

VII. To detect combustion instability in the MA-3 engines for safety and failure analysis purposes:

ADD:

B1 NAA ACCEL BK-U
B2 NAA ACCEL BK-U
B1 RCC BIN CTR BK-U
B2 RCC BIN CTR BK-U
B1 RCC BACK-UP RELAY
B2 RCC BACK-UP RELAY

VIII. Due to recent difficulties experienced on Missile 54-D's autopilot programmer, a method is needed to show proper programmer operation just prior to launch. These measurements will provide a record for proof of proper sequence operation or data for failure analysis. These measurements will be made during the Integrated Systems Tests of the A/P programmer:

ADD:

S1370X	STAGING
S1371X	BOOSTER JETTISON
S1372X	PRESSURE VERN TANK
S1373X	BOOSTER CUTOFF
S1374X	SUSTAINER CUTOFF



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16 August 196^



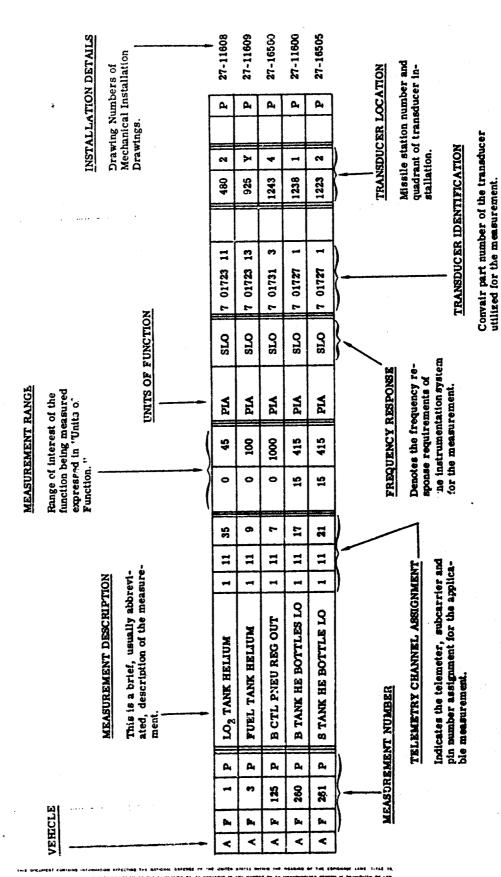
MEAS. NO.	DESCRIPTION
ADD:	
S1375X	VSHP™ BACK-UP SIGNAL
S1376X	VERNIER CUTOFF
S1377X	EJECT RUUMBILICAL
S1378X	RV JE TTSON
S1079X	FIRE RETRO ROCKETS

CONVAIR-ASTRONAUTICS

SECTION 8

MISSILE INSTRUMENTATION BY SYSTEM

The Missile Instrumentation Log presented in this section con ains the latest available characteristics of the individual measurements. In addition, the telemetering channel assignments are included. Note that this section is listed by system.



NOTE: For a more detailed explanation of this format and a key to abbreviations and coding see the IBM Code Key in the Summary report.



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MISSILE INSTRUMENTATION LOG SHEET DATE 16 AUG 60 MISSILE 16 16 17 SUB-CARRIER NO. COMMUTATOR VILEMETTE NO UNITS FUNCTION MEASUREMENT DESCRIPTION 8 FOM HIEH 27 30 31 32 35 34 35 AIRFRAME 285 I THRUST SECT LITE BL 7.01709 27-11733 744 I THRUST CECT LITE BZ 3 11 3 0 600 FTC 7 01709 1220 2 P 27-117-3 483 T AND F STG VLV G3 1 11 15 MM100 300 MDGF SLO 27 01287 27-11793 SLO 27 01287 1 11 13 MIOO 300 DGF 636 T AFT SIDE A FRAME QZ 27-11793 1 11 45 4100 300 DGE 27-11793 300 DGF 640 T FWD SICE A FRAME 1 11 31 | 1100 27-11793 300 ÚGE 27-11793 300 DGF 27-11794 33 8100 300 DGE 27-11794 RANGE SAFETY SYSTEM CETRICAL POSER SYS 5 V 1 400 CYCLC AS FRASE C 1 13 23 135 125 PHILLIATIC LYST. M. 0 100 PIA 27-11683 3 P FUEL TAUK HELIUM 1 13 37

SECTION 8

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MISSILE	INSTRUMENTATION LOG SHEET	
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1 251 0	ALIMUTH SERVO ERROR	7	11	35	H5.1	5.1	MIN		100			∥	\vdash	М	
1 552 0	REDNOT GYRO PICK-OFF	2	7		H2.7	2.7	MIN		35			I	Ш	ρ	
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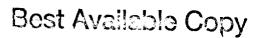
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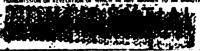


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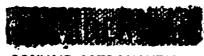
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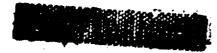
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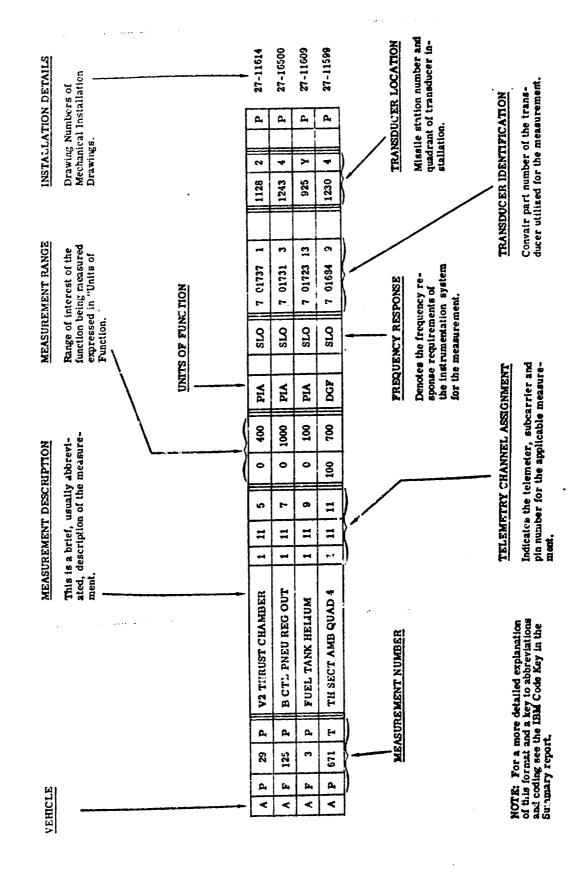


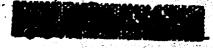
CONVAIR-ASTRONAUTICS

The Missile Instrumentation Log presented in this section contains the latest available characteristics of the individual measurements. In addition, the telemetering channel assignments are included. Note that this section is listed by channel.

MISSILE INSTRUMENTATION BY CHANNEL

SECTION 9





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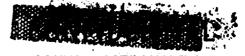
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- MENICLE	Mick	MEASUREMENT	TYPE MEASUREMENT .	 	TELEMETER NO	SUB-CARRIER NO	COMMUTATOR PIN NO.	MEASL	PREMENT NGS HIGH	UNITS OF FUNCTION	ACCURACY	RATE OF CHANGE OR PREQUENCY SO OF FUNCTION	TYPE OF TRANSDUCER	SERIAL NO.	STATION NO.	QUADRANT	CALB CORE	BRAWING NUMBERS
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	†		17	S LOZ PUMP INLET	1	12	17	0	150	PIA		SLO	27 01243 9	0037F	1235	x	Р	27-11720
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T-Carrie	INTER	3	TTO MEASUREMENT	DESCRIPTION	TREMETER NO.	SUBCABIER NO	COMMUTATOR 714 NO	[[]	REMBHT NGB HIGH	UMITS OF FUNCTION	ACCUEACY	SATE OF CHAMER OR PREQUENCY OF PUNCTION	OF TEANSDUCER	SITIAL NO.	STATION MG.	QUADRAMT	CARD CODE	DRAWING NUMBERS
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Γ	U			ERROR RATIC DEMOD CP	,	A		[VDC		SLO		,			P	
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	Р	28	P	V1 THRUST CHAMBER	1	A	33	0	400	PIA		SLO	7 01737	1167	1127	4	P	27-11699
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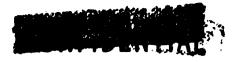
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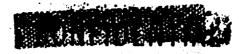
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CONVAIR-ASTRONAUTICS

REPORT NO. A2C-27-059-4

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MISSILE INSTRUMENTATION LOG SHEET

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1	SYSTEM	MEASUREMENT	TYPE MEASUREMENT .	DESCRIPTION	TELEMETER NO .	SUB-CARRIER NO.	COMMUNATOR	22 81	MEASUREMENT RANGE	UNITS OF FUNCTION		BATE OF CHANGE OF PREQUENCY OF FUNCTION	15 Y-PE OF TRANSDUCER	SERIAL NO.	STATION NO	DUADRAM	CARD COOF	DRAWING NUMBERS
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1	р	6 0	Р	B1 THRUST CHAMBER	2		-	نبله	0 600	TIA		15	7 01731 1	6296	1244	Y	Р	27-11684
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SECTION 9

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CONVAIR ASTRONAUTICS

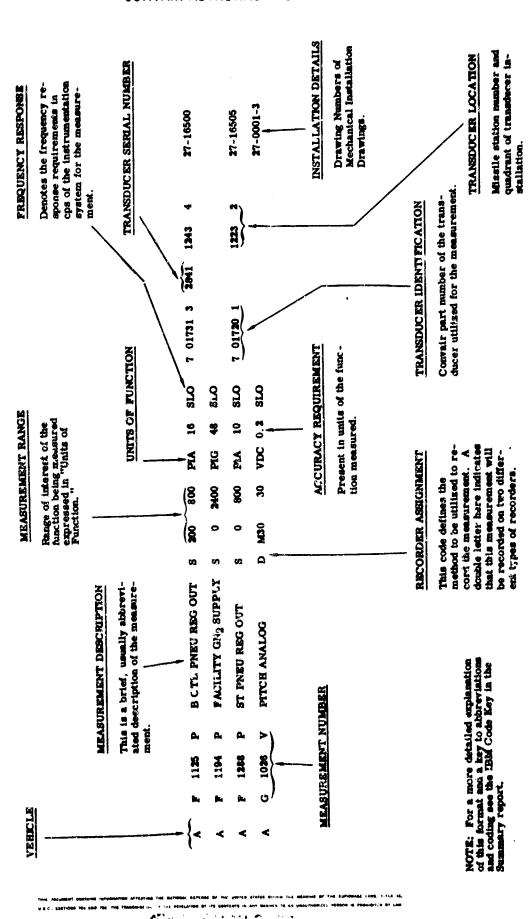
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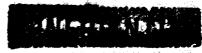
CONVAIR-ASTRONAUTICS

SECTION 10

LANDLINE INSTRUMENTATION

The Landline Instrumentation presented in this section contains the latest available characteristics of the individual measurements. In addition the type of recordings indicated.





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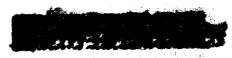
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SECTION 10

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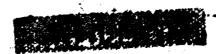
SECTION 10

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MISSILE INSTRUMENTATION LOG SHEET

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3-1-		BZ LUBE OIL INJ MAN	5			,		-20		7 01731 7	5750	1100	П	П	27-11722
P 11	89 0	BI GAS GEN LOZ IN	0		0	1000	PIA		14				#	P	
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CONVAIR-ASTRONAUTICS

REPORT NO. AZC-27-059-4

SECTION 10

16 AUGUST 1960

1 2 1	4 [1]	7.	, ,	 -	•	10	11	,1	111		14	III .	144	1	i
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P M430	P FUEL STORAGE TANK		M	(10	PIC		SLO	₩			₩	_	P	
P 1465	P S LO PR LUBE OIL MAN	1	S		100	PIC		SLO	27 012	3 .	0054F	123	5 X	P	27-11720
P 1474	P V CTL PRESS REG OUT		5	200	800	PIA	16	SLO	7 017	1	4643	120	3 4	P	27-11651
			•				ļ		 			₩		$\parallel \downarrow \parallel$	
P 1020	T B1 LO2 PUMP INLET	14	\$	M325	M275	DGF		SLO	7 016	9 9	772	₩	\perp	0	
P 1151	FUEL TK @ STA 1043		s	11 0	200	DGF	5	SLO	7 016	4 1:	405	Щ	$oldsymbol{\perp}$	P	
P 1204	BI TOPPING LINE OUT		s	M300	M270	DGF	_	20					. _	Р	
P 1205	B2 TOPPING LINE OUT		5	M300	M270	DGF		20				∭	\perp	ρ	
P 1325	ENG COMP AMBIENT		S	M100	500	DGF	3	SLO	7 0160	4 5	273	1208	1 4	P	27-11651
P 1709	SGG COMBUSTOR		5	0	1500	DGF		3	27 0124	7 3	33L	1234	. 4	P	27-11720
P 1710	SE ENVIRONMENT	ļ. ļ.	s	M100	500	DGF		SLO	7 0168	4 5	170	1235	2	P	27-17540
P 1711	B1 NACELLE AMBIENT		5	M100	500	DGF		SLO	7 0168	4 5	R283	1204	. 4	P	27-17546
P 1712	BE NACELLE AMBIENT		5	M100	500	DGF		SLO	7 0166	4 5	R284	1204	2	p	27-17546
P 1713	BI GAS GEN COMBUSTOR		5	0	1500	DGF	30	5	27 0124	7 3	52	1210	1	P	27-11721
P 1714	B2 GAS GEN COMBUSTOR		s	 0	1500	DGF	30	5	27 0124	7_3	57	1210	3	P	27-11722
							-		a.				Ш		
P 1437	S RCC BINARY COUNTER		A	0	100	MS	.5	2KC						P	
P. 1454	B1 RCC BINARY CNTR		A	0	100	MS	,5	SKC						P	
P 1455	82 RCC BINARY CHTR		A	0	100	MS	.5	SKC						P	
P M849	LO2 SLUG XFER & FIRE		M											P	
P 1897	BI RCC BIN CNT BK U		A	o	100	MS	. 5	ZKC						9	
P 1898	B2 RCC BIN CNT BK U		A	0	100	MS	.5	2KC					\prod	p	
								٠							
P 1155	OBSERVER CUTOFF		R	OFF	ON	voc	,	STP	PE	N 69				P	
P 1161	TCC START SWITCH		R	OFF	ON	VDC		STP	PE	N 6				p	
P 1164	TCC ENGINE COF SW		R	OFF	ON	VDC		STP	PE	4 67				P	
P 1192)	BI ROUGH COMB COF		R	OFF	ON	VDC		STP	PE	76				P	
P 1193	BZ ROUGH COMB COF		R	OFF	ON	VDC		STP	PE	1 77				P	
P 1225)	ENGINE CONTROL READY		P	OFF	ON	VDC		STP						P	
	111	-	- 1	di T	11	1 · T	7	1	1		· I			[7	

SECTION 10

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MISSILE INSTRUMENTATION LOG SHEET

N	1155	ILE	HE L	ANDLINE PEPORT NO.	AZ	C-2	7-0:	79-4		MENI			DG SHEET		PAGE		6	
Ī	1.	1	1.		•	,	•		•	11.0	11	13	1	н	19	16	177	
WENDER B	STIME	MEASUREMENT	S WEASUMEMENT	DESCRIPTION	RECORDER	TRACK	CHANNEL	B.A.	REMENT NOS	UNITS OF FUNCTION	ACCURACT	RATE OF CHANGE OR PERQUENCY OF FUNCTION	TYPE OF TRANSDUCER	SERIAL NO.	STATION NO.	QUADRANT	CARB CODE	DRAWING NUMBERS
	-		M.	19	-	1112		10 M	HIGH H 42	43 44	l	1 I	120 MARRIE MAN	12 H	67 70	71	n	
·		1			-			OFF	ON	VDC		STP					P	}
	_	1	11	LO2 DOME PURGE	-	R		 	1	11		1	 			\vdash	1	1
	P	1221	1.	IGNITER FUEL PURGE	┞	R		OFF	ON	VDC		STP		 	 	-	P	
	P	1229	X	LO2 HIGH TOPPING	-	R		OFF	ON	VDC		STP	<u> </u>			-	P	
	P	1230	X	LOZ LOW TOPPING	-	R		OFF	ON	VDC		STP			 	\vdash	P	
_	P	1231	L X	LOZ 100% SLUG COM	L	R		OFF	ON	VDC		STP				-	P	
	P	1347	X	S CUTOFF RELAY	L	R		OFF	ON	VDC		STP	PEN 128			_	P	
	P	1436	X	S ROUGH COMB COF	L	R		OFF	ON	VDC		STP	PEN 78		ļ	L	P	
	P	1544	×	VERNIER CONTROL		R		OFF	ON	VDC		STP				L	ρ	
_	P	1545	×	S IGN STAGE CONTROL		R		OFF	ON	VDC		STP					Р	
	P	1546	X	B2 CUTOFF RELAY		R		OFF	ON	VDC		STR					P	
				B1 CUTOFF RELAY		R		OFF	ON	VDC		STP					P	
7			1	COMPLETE COF RELAY		R		OFF	ON	VDC		STP					Р	
-			1	IGNITION START		R		OFF	ON	VOC		STP					P	
-			1		-					1								
-			1	B SECONDARY SHUTDOWN		3		OFF	ON	VDC		STP			-		Р	
-	P	1975	X	81 RCC BACK-UP RELAY	-	R		OFF	ON	VDC		STP	PEN 73				ρ	
4	P	1976	X	BZ RCC BACK-UP RELAY	-	R		OFF	NO	VDC		STP	PEN 80		ļ	\vdash	Р	
4	_		 		-					 					-	Н	#	
_	5		\sqcup	AUTOPILOT SYSTEM						 						Ш	₩	
_																		·
	5	M358	D	ROLL PROGRAM READOUT		M											P	
																	L	
	5	1048	v	PROGRAMMER PITCH SIG		D		0	2.7	VAC	. 2	SLO					P	
1	5	1049	V	PROGRAMMER ROLL SIG		D		0	60	VAC	3	STP					P	
7	5	1107	V	BI PCH ACTR FEEDBACK		D		M12	12	VAC	5%	30					P	
1			1-1	82 PCH ACTR FEEDBACK		D	_	M12		VAC		30				\neg	Р	
1	-			VI YAW ACTR FEEDBACK		D		MS		VAC		30				7	P	
-	-		1-1	VZ YAW ACTR FEEDBACK		0	-#	MS		VAC	5%	30				7	P	
-	_				H											\neg	P	
-	_			V2 ROL ACTR FEEDBACK	\vdash	0	#	M11	7	VAC						-	P	
-	-1			VI ROL ACTR FEEDBACK	_	0		M11		1							\sqcap	
-	_		1	GYRO TEST SIG	\dashv	D	#	MS		VAC		STP	 			-11	P	
-				SERVO TEST SIGNAL	-	D		M11		VAC						7	P	
-			1	BI YAW ACTR DEEDBACK		D	#	M12		VAC	5%	30					P	
_	5	1129	V	B2 YAW ACTR FEEDBACK	_	D		M12	12	VAC	5%	30				\parallel	P	
J	ļ				j	1		1 1		1]	1)	1	·	,	-]]	1 1	



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MUSEC 4E LAND	DETNE PEPORT NO	AZC-27-	MISSILE	INSTRU 	MENT		N LO	OG SHEET 16 AUG 60		PAGE		7	
VEHICLE NUMER NATEM NATEM NAMER NAME	i	# #	LOW LOW	REMENT IGE HIGH	OF FUNCTION =	`	AATE OF CHANGE OR FREQUENCY OF FUNCTION		SERIAL NO.	STATION NO.	QUADEANT	2 CAMB CODE 2	DEAWING NUMBERS
	PITCH GYRO AMP		11		vac		30	\$253 \$455545756 \$74061	47 64		Í	P	
1 1		ס		10	VAC	1	30			 	\perp	P	
	ROLL GYRO AMP OUT	D	M10	10	VAC	1	30	•		 		∥P.	
1 7 1 1 111	S PCH ACTR FEEDBACK	D	M10	10	VAC	5%	30					P	
	S YAW ACTR FEEDBACK	D	M10	10	VAC	5%	30			<u> </u>	Ц	Р	
h	FINE HEATER-PITCH	М	0	150	VAC					<u> </u>	Ш	Р	
1	FINE HEATER-YAW	М	0	150	VAC							P	
	FINE HEATER-ROLL	M	-11:	150								P	
3 M212 V	TANK THE TEN NOTE												
	مساور دوردور			999	SEC	,						P	
F-1-1-	PROGRAM RUN TIME	M	11	10K	1							ρ	
S MZBZ W	DECADE EVENT TIMER	+			J-5-								
												P	
	PROGRAMMER RUN TIME	R	OFF	1	VDC		STP					P	
5 1370 X	STAGING	- R	OFF		VDC		STP			#	1		
5 1371 X	BOOSTER JETTISON	R	OFF	OM	VDC		STP				†-	P	
5 1372 X	PRESSURIZE VERN TANK	R	OFF	ON	VDC		STP				十	P	
5 1373 X	BOOSTER CUTOFF	R	OFF		VDC		STP		-		+	P	ų.
5 1374 X	SUSTAINER CUTOFF	R	OFF	ON	VDC		STP				╁	P	
5 1375 X	VSHPS BACK-UP SIG	R	OFF	ON	VDC		STP		 	 	╀	P	
S 1376 X	VERNIER CUTOFF	R	OFF	ON	VDC	ļ	STP			₩		ρ	
5 1377 X	EJECT RV UMBILICAL	R	OFF	ON	VDC		STP					p	
	RV JETTISON	R	OFF	ON	VDC	<u> </u>	STP		ļ	₩	+	Р	
	FIRE RETRO ROCKETS	R	OFF	ON	VDC	! 	STP		 	₩		P	
			4		<u> </u>	<u> </u>				 		Ш	
τ	TELEMETERING SYSTEM						-			 			
										 			
T M140 V	TLM #1 BAT DC	М							<u> </u>			ρ	
1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	TLM #1 EXTERNAL DC	1	114									P	
	TLM #2 BAT DC					1				II		P	
1 1 1	TLM #2 EXTERNAL DC								<u></u>			P	
	TLM #3 BAT DC	١,				1						P	
2		1 1										ρ	
	TLM #3 EXTERNAL DC	1 1	11.									p	
T M156 V	TLM 1 FIL INT DC	T .	!	4 v = - = - = - = - = - = - = - = - = - =	1				1				

SECTION 10

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MISSILE INSTRUMENTATION LOG SHEET

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1 1 1 1 1	10 7			, w	# 42	41 24	4 40 4	31	5253 \$455565756 \$740 A.	N #	į,, ~ ~	- 1	ا ا	
1 1	TLM I FIL EXT DC	M						i					P	
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		+				•					 		"	
T M150 W	TLM #1 TOTAL	м	+	_	1000	ЫĐ	,				 	-	P	
	TEN #2 TOTAL	М					<u> </u>					-	þ	
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Y M135 W	TLM #3 BATTERY	M		0	_60	HIN				 		-	F	
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U	PROPELLANT UTILIZ								<u> </u>		<u> </u>	-	4	
		 		ļ-—		 					ļ	ļļ		
U 1091 V	ERROR RATIO DEMOD OP	5		MZQ	20	VDC	.5	20		ļ		-1	Р	
		 	 	ļ		 	-			ļļ	ļ	\sqcup	$\parallel \parallel$	
U 1200 X	LO2 100% SLUG COF-1	R		OFF	ON	VDC	\$	ŤΡ			<u> </u>		Р	
U 1201 X	LOZ TOPG HI CTL-1	R	 -	SER	ON	VUC	s	14	Ĺ		<u> </u>		Р	
J 1202 X	LOZ TOPG LO CTL-1	R		OFF	ON	VOC	s	T P					P	
U 1203 X	LO2 95% RAPID LOAD-1	R		OFF	ON	VDC	s	TP					Р	
	FUEL 100% SEC CTL	R		OFF	ON	VDC	s	TP.					ρ	
U 1205 X	FUEL 100% ORI CTL	R		OFF	ON	VDC	s	TF.					Р	
N 300 X	FUEL 95% SEC CTL	R		UFF	ON	VDC		TΡ					p	
U 1207 X	FUEL 95% PRI CTL		!!	OFF	ΛN	VDC	5	TΡ					ρ	
U 1208 X	LO2 100% SLUG COF-2	R	i	0	ON	VDC	ç	ΤP					Р	
U 1209 X	LOZ TOPS HI CTL-2	R		OFF	04	VDC	5	TΡ					p	
	LUZ TOPG LO CTL-Z	P	1	OFF		VDC		ΤP					P	
	LC2 SOR RAPID LOAD-2	1		OFF	1	VDC	•	† † †) 				p	
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BATE 10 May 1960

CONVAIR (ASTRONAUTICS) DIVISION GENERAL DYNAMICS CORPORATION

ASTROMABITIES

DEC 13 1800 LIDKARY

WS-107A-1

INSTRUMENTATION CONFIGURATION

SERIES E ARTICLE 8

AMR

PREPARED BY TEST PLANNING

CO-ORDINATED BY W. Dec

W. S. Becker

AFFROVED

H سهروي

- H. R. Macdonald

Test Planning

CHECKED BY

T. M. Wooster

Instrumentation

APPROVED BY.

P. J. Lynch Chief - Field Test

Engineering

GD

1/a document exclains information effecting the national defense of the United States within the recenting of the Scrienage Laws, 19th 8, U.S.C., Section 793 and 794, the transmission or revolution of which in any manage to an exceptionized parent is problemed by how



REPORT NO. AZC-27-059-8 PAGE NO. A 31 October 1960

REVISIONS

HO.	DATE	87	CHANGE	PAGES AFFECTED
A	20 Oct. 160	WSB	ADDITIONS:	
			EM109W, EM110W, F3309D, F1194P, F3301P,	ALL TABS
			F3302P, F1826P, F1828P, F1827T, F1829T,	
			F3831T, F3832T, F3833T, F3834T, F3835T	
			F3836T, F3837T, F3838T, G302C, G588P,	
			G589P, G281V, H52P, H130P, H185P,	·····
			11606V, N3335X, N3336X, N3337X,	
			N3056X, N3932X, N3933X, N1979X, P155P,	
···			P184P, P185P, P188P, P341P, P473P,	
			P1020T, P1054T, P1225X, P1226X, P1227X	
			P1228X, P1229X, P1230X, P1231X, S1370X,	
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			FM248P, F230T, FM230T, P419P, P420P,	
			P1279P, P1341P, P1473P, P1709T, P1713T	

REVISIONS

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A	20 Oct 160	WSB	DECETIONS: (CONTD)	ALL TABS
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31 October 1960

FOREWORD

This report has been published in accordance with contractual requirements as cited in Convair-Astronautics Report ZM-7-289. It describes the instrumentation released for missile 8E as of 31 October 1960.

(A)

Information presented here will be used by Air Force, Associate Contractors, Design, Operation, and Field Test Groups. Measurement modification will either originate in the Instrumentation Planning Group or will be submitted as a recommendation to this group.



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Landline Instrumentation	10



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10 MAY 1960

SUMMARY

The instrumentation configuration for this missile has been established through a study of program test objectives, systems analysis, and operating considerations. A discussion of missile instrumentation and associated characteristics has been summarized in Report AZC-27-059. For a detailed description of the various missile systems, test objectives, and general test program see Report AZC-27-044.

The specific measurements to be transmitted via telemeter have been tabulated and are listed in Sections 8 and 9 in terms of instrumentation system and telemeter channel assignments.

In addition to the telemetry, the landline instrumentation program for this missile has been included in this report in the form of a master tabulation of landline measurement characteristics, (Section 10).

To clarify specific measurements, instrumentation location schematics have been included in Report AZC-27-059, Section 7.

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REASONS FOR REVISION "A" CHANGES

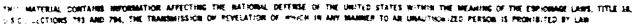
i. The helium controls bottle charging line is being rerouted into the instrumentation port, no additional port is available. However the necessary design information will be gathered on prior missiles.

MEAS. NO.	DESCRIPTION	CHANNEL
DELETE		
F290T	S CTL HE BOTTLE	1.11.41
FM290T	S CTL HE BOT ILE	

II. The following measurements were added to provide a record for proof of proper sequence operation or data for failure analysis. These measurements will be made during the integrated systems tests of the A/P Programmer.

ADD	
S1370X	STAGING
S1371X	BOOSTER JETTISON
S1372X	PRESSURIZE VERN TANK
S1373X	BOOSTER CUTOFF
S1374X	SUSTAINER CUTOFF
S1375X	VSHPS BACK-UP SIGNAL
D1376X	VERNIER CUTOFF
S1377X	EJECT RV UMBILICAL
S1378X	RV JETTISON
S1379X	FIRE RETRO ROCKETS

III. Administrative difficulties make it desirable to assign different measurement numbers for the new CVA dual LO₂ tanking probes.







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MEAS. NO.	DESCRIPTION	CHANNEL
ADD		
U1208X	LO ₂ 100% SLUG COF - 2	
U1209X	LO_2 TOPG HI CTL - 2	
U1210X	LO ₂ TOPG LO CTL - 2	
U1211X	LO ₂ 95% RAPID LOAD - 2	

IV. There is no sustainer LO_2 tank pressurization bottle on E series missiles, therefore the following measurement has been deleted.

DELETE

FM248P

S TANK HE BOTTLE H1

V. Complexity prohibits making or calibrating this measurement in a way that will yield valuable data for test evaluation.

DELETE

Z2E

ADD

KLYSTRON PWR OUTPUT

1.11.1

VI. These measurements have been added to determine if proper sequencing of LO₂ slug transfer valves is occurring.

ADD	
N2335X	SLG CH LO2 DISCH VLV
N3932X	LO ₂ TPNG VLV CLOSED
N3933X	LO_2 TPNG VLV OPEN
N3336X	SLG CH LO2 VENT VIV
N3356X	SLG CH LO2 LOW LEVEL
N3337X	SLG CH LO2 INLET VLV
N1979X	PRESS VLV CLOSED



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VII. The following instrumentation is required to evaluate and determine proper operation of the redesigned AIG pod air conditioning:

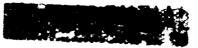
MEAS. NO.	DESCRIPTION
ADD	
F1826D	AIG POD AIR INLET Q-2
F1827T	AIG POD AIR INLET Q-4
F1828P	ALG POD AIR INLET Q-3
F1829T	AIG POD AIR INLET Q-3
F3831T	EXHAUST AREA AMB TEMP
F3832T	FWD FACE PLATE SKIN
F3833T	FWD FACE PLATF SKIN
F3834T	FWD FACE PLATF SKIN
F3835T	AFT FACE PLATE SKIN
F3836T	AFT FACE PLATE SEIN
F3837T	AFT FACE PLATT SAIN
F3838T	POD AMB TEMP

VIII. The following sequence measurements will be used for flight test and systems validation, by providing time-sequence of operation of these functions during ground checkout.

<u> 1100</u>	
P1225X	ENGINE CONTROL READY
P1226X	PNEUMATICS CUTOFF
P1227X	TO ₂ DOME PURGE
P1228X	IGNITION FUEL PURGE
P1229X	${ m LO}_2$ HIGH TOPPING
P1230X	LO ₂ LOW TOFPING
P1231X	LO ₂ 1007 SLUG
	-

IX. The Booster Lax Pump Inlet temperature mea prements have been added as operational redlines.

THIS MATERIAL CONTAINS INFORMATION AFFECTING THE NATIONAL DEFLOR OF THE STATES WITHIN THE MEANING OF THE ESPIONALL LAWS LITTLE BEST OF THE DEAL THE TRANSMISSION OR RELATING OF THE STATES WITHIN THE MEANING OF THE ESPIONAL LAWS.



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31 October 1260

MEAS. NO.	DESCRIPTION	CHANNEL
ADD		
P1054T	B2 LOX PUMP INLET	
P1020T	B1 LOX PUMP INLET	

X. The following measurement is added to ascertain the adequacy of the GN2 supply during countdown and bolds.

ADD

F1194P

FACILITY GN2 SUPPLY

XI. The flight of missile 3-E revealed that data was insufficient to properly analyze operation of the airborne sustainer hydraulic system. These additional measurements are necessary to evaluate possible hydraulic system anomalities.

ADD	

H521 [*]	S HYD ACCUMULATOR	1.A.3
H185P	S HYD PUMP INLET	2.11.4!
H : :0P	S HYD PUMP DISCH	1.A.21

XII. The following measurements will be used to determine the cause of impact predictor drop out experienced on the GE - IP System on "D" AIG flights.

ADD		
G588P	WAVEGUIDE PRESSURE 1	1.12.7
G589P	WAVEGUIDE PRESSURE 2	1.12.9
G281V	RB REFLECT SET	1.11.49
G302C	PR-IR MODULATOR AVG	1.11.53

PAGE NO. 4-5

31 October 1960

XIII. In order to gain data on the performance of the MA-3 turbopump lube oil and pressurization systems during flight, 3 lube oil pressure measurements were switched from landline to telemetry.

MEAS. NO.	DESCRIPTION	CHANNEL
DELETE		
P1279P	B2 LO PR LUBE OIL MAN	
P1341P	S LUBE OIL MANIFOLD	
P1473P	B1 LG PR LUBE OIL MAN	
ADD		•
P279P	B2 LO PR LUBE OIL MAN	2.11.43
P341P	S LUBE OIL MANIFOLD	2.11.47
P473P	B1 LO PR LUBE OIL MAN	2.11.45

XIV. The booster turbopump gearbox pressures will be recorded during flights to gain data on turbopump gearbox pressurization system performance and over-all turbopump reliability.

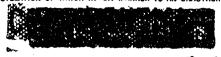
ADD

F135P	B1 TURBOPUMP GEARBOX	2.11.49
P188P	B2 TURBOPUMP GEARBOX	2.11.51

XV. In order to assure that the orifices have been properly sized in the booster gas generator ${\rm LO}_2$ feed lines, the following changes were made:

ADD		
P155P	B1 GAS GEN COMBUSTOR	1.12.23
P184P	B2 GAS GEN COMBUSTOR	1.12.33
DELETE		
P419P	B1 GG LO ₂ INJ MAN	1.12.23
P420P	B2 GG LO ₂ INJ MAN	1.12.33

THIS MATERIAL CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEATING OF THE ESPIONAGE LAWS, TILLE 18, U.S.C., SECTIONS 793 AND 794, THE TRANSMIS ON OR REVELATION OF WHICH IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY 'AW.



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XVI. This measurement will indicate the number of guidance computer off-on cycles and help to establish the computer run time when combined with measurement I1510W.

MEAS. NO.

DESCRIPTION

CHANNEL

ADD

11606V

COMPUTER RESET

XVII. The following measurements are FRF instrumentation. Missile 8E will not be FRF'd.

DELETE

P1709T

SGG COMBUSTOR

P1713T

B1 GAS GEN COMBUSTOR

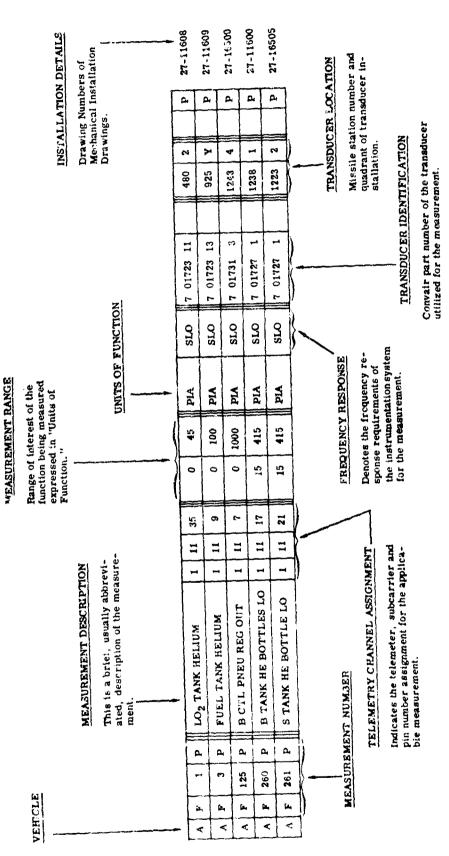
P1714T

B2 GAS GEN COMBUSTOR

CONVAIR-ASTRONAUTICS

MESSILE INSTRUMENTATION BY SYSTEM

The Missile Instrumentation Log presented in this section contains the latest available characteristics of the individual measurements. In addition, the telemetering channel assignments are included. Note that this section is listed by system.



NOTE: For a more detailed explanation of this format and a key to abbreviations and coding see the IBM Code Key in the Summary report.



CONVAIR-ASTRONAUTICS

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SECTION 8

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SECTION 8



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SECTION 8

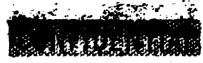
31 OCTOBER 1960



CONVAIR-ASTRONAUTICS

REPORT NO. AZC-27-059-8 DATE 31 OCT 60

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CONVAIR-ASTRONAUTICS

REPORT NO. AZC-27-059-8
SECTION 8

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MISSILE INSTRUMENTATION LOG SHEET

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		STUMES ==	MANAGEMENT	MEASUREMENT	DESCRIPTION	MUSARTIRE INC.	ğ	COMMUTATOR PIE MO.	MEASI	Sandert Market	UMITS &	ACCURACY =	S OF CHAINGE PRECHOSE F PUSCHOSE	TYPE OF	MO.	STATION NO.	MAATT	CA16 CO06 %	DEAWING NUMBERS
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SECTION 8

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SECTION 8

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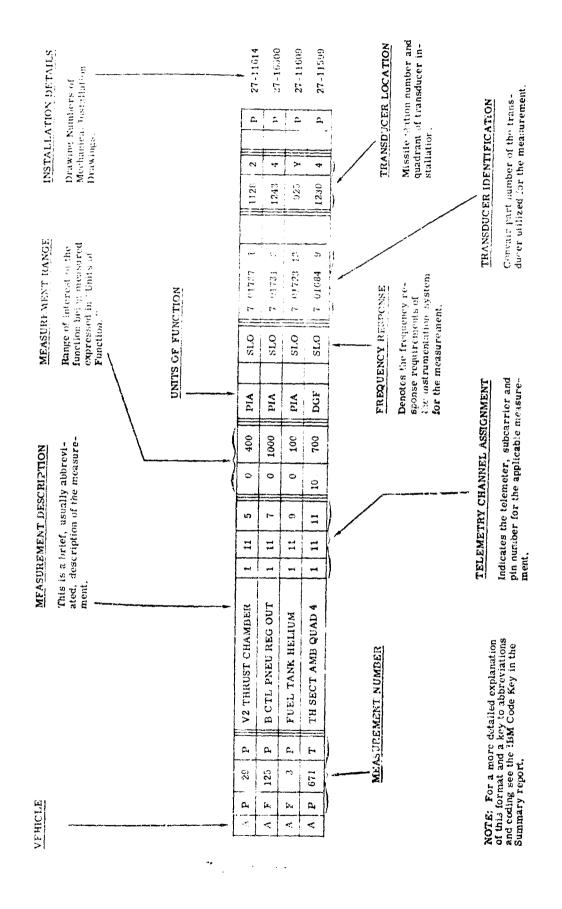
MISSILE INSTRUMENTATION LOG SHEET

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SECTION 9

MISSILE INSTRUMENTATION BY CHANNEL

The Missile Instrumentation Log presented in this section contains the latest available characteristics of the individual measurements. In addition, the teiemetering channel assignments are included. Note that this section is listed by channel,

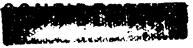




REPORT NO. AZC-27-059-8 SECTION 9 31 OCTOBER 1960

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	SYSTEM	MEASUREMENT	TYPE MEASUREMENT .	DESCRIPTION	TELEMETER HO	SUB-CARRIER NO. 4	COMMUTATOR P	MEASUREMENT RANGE LOW MIGH		OF SUNCTION	ACCURACY =	OR PREQUENCY	n	TE OUCER	SERIAL NO.	STATION NO.	EAM	CAID CORE 3	DEAWING NUMBERS
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THIS MATERIAL CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ES-MONAGE LAWS, TITLE IS IT SO SECTIONS TO AN UNAUTHORISTS DESCRIBED BY SOME AND A LAW.



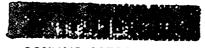
SECTION 9

31 OCTOBER 1960



CONVAIR-ASTRONAUTICS

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*****	TOWN.	- trium	MANUSTREM! WOMBER	TTPE MEASUREMENT .	DESCRIPTION	TELEMETER NO	SUBCARRER NO	COMMUTATO FIN NO.	MEAS:	P BANKERT BANK BANK BANK BANK BANK BANK BANK BANK	UNITS OF FUNCTION 62	ACCURACY	RATE OF CHANGE OR PRÉPJENCT CO PEUNCTION	FRANSDUCER	I4 SERIAL MO.		QUADEANT	CARB CODE	DRAWING NUMBERS
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		۴	247	T	B TANK HE BOTTLES	1	11	35	M400	∯ 250	DGF		SLO	7 01633 5	28	1221	4	P	27-11682
I		A	641	T	AMB F STG VLV Q1	1	11	37	M100	300	DGF		SLO	27 01287 3	21276		$ lab{I}$	Ρ	27-66793
	I	P	671	T	TH SECT AMB QUAD 4	1	11	39	M100	300	DGF		SLO	27 01287 3	21318		bracket	ρ	
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		F	17	T	FUEL PRESS ORIFIC IN	1	11	43	0	500	DGF		SLO	7 01684 3	50123	1120	1	þ	27-11732
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CONVAIR-ASTRONAUTICS

REPORT NO. AZC-27-059-8

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31 OCTOBER 1960

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	WEMICIE	. PATTER	MEASUREMENT	TYPE MEASUREMENT	DESCRIPTION	TELEMETER NO	SUPCARETE NO	COMMUTATOR FIN NO	MEASU	REMENT NGB MIGH	UNITS OF FUNCTION	ACCURACY	RATE OF CHANGE OR PREQUENCY OF PUNCTION	OF TYPE	SERIAL MO.	STATION NO.	2	CARD COM	DEAWING NUMBERS
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		1	53	3 T	BINNACLE	1	12	5	0	100	DGC	ļ	SLO			Щ	Ш	P	
Ā		G	58	8 P	WAVEGUIDE PRESS 1	1	12	7	0	15	PIA		SL/	7 01255 1			Ц	P	
4		G	58	9 P	WAVEGUIDE PRESS 2	1	12	9	0	15	PIA	<u></u>	SLO	7 01255 1			Ц	P	
		1	54	0 V	CONTROL 115 PHASE B	1	12	11	0	130	VDC		510			Ⅲ	Ц	P	
		1	53	4 T	ANALOG SIG CONVERTER	1	12	13	0	100	DGC		SLO			II	Ц	Р	
		ı	57	2 P	BINNACLE	1	12	15	o	41	PIA	<u> </u>	SLO				Ц	P	
		F	14	5 P	S CTL HE BTL DISCH	1	12	17	0	3500	PIA		SLO	7 01720 5	5631	1213	2	P	27-11650
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		ı	54	1 v	CONTROL M22.5 PSUP	1	12	21	0	25	VDC		SLO					P	
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		P		++	B2 GAS GEN COMBUSTOR	+		\vdash	-	1000	PIA		SLO	1		1144	П	П	27-11720
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€ 28	V MSL SYSTEMS INPUT	1 13				VDC		10			₩	╢	
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ŧ		5 1	٧	400 CYCLE AC PHASE A	1	1	1	105	125	VAC	<u> </u>	SLO		11	Щ	Ш	P	
н		52	ρ	S HYD ACCUMULATOR	1	4	3	<u></u>	3500	PIA		SLO	7 01720	<u> </u>	Щ	Ц	Р	
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5		1	D	ROLL DISPL GYRO SIG	1	A	_ 9	МЗ	3	DEG		5		11		Ш	P	
5		2	0	PITCH DISPL GYRO SIG	1	A	11	м3	3	DEG		5		11			P	
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	Mescus	-	¥	TTPE MEASUREMENT	DESCRIPTION	TREMETER NO	SUFCABBIER NO	COMMUTATOR PIN NO	MEASU &A.	REMENT NGS HIGH	UNITS OF PUNCTION	ACCURACT	NATE CY CHANGE OR PREQUENCY OF FUNCTION	1 ·\$	SERIAL HO	STATION NO.	П	CARS COSS	DRAWING
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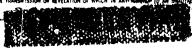
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	1	TYPE MEASUREMENT	DESCRIPTION	· EMETER NO	2	COMMUTA	LOW	нен	UNITS OF FUNCTION	ACCURACY	RATE OF CHANGE OR SREQUENCY OF SUNCTION	TRANSDUCER	SERIAL NO	STATION NO	GUNDEANT	ביונה כספנ	DRAWING NUMBERS
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5	223	0	AS blach	2	E	5	ن	50	DEG		10	7 01414	1 07675	1123	2	P	27-11699
3	222	D	V1 PITCH	2	<u>E</u>	7	0	50	DEG		10	7 01414	1 08327	1123	4	P	27-11699
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5	233	D	VI YAW ROLL	2	£	13	M70	70	DEG		1)	27 01205	290	1124	4	P	27-11699
5	254	O	BZ PITCH ROLL	2	E	15	M5	5	DEG		10	7 01680	7 893	1212	Y	ρ	27-11722
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SECTION 9

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CONVAIR ASTRONAUTICS

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SECTION 9

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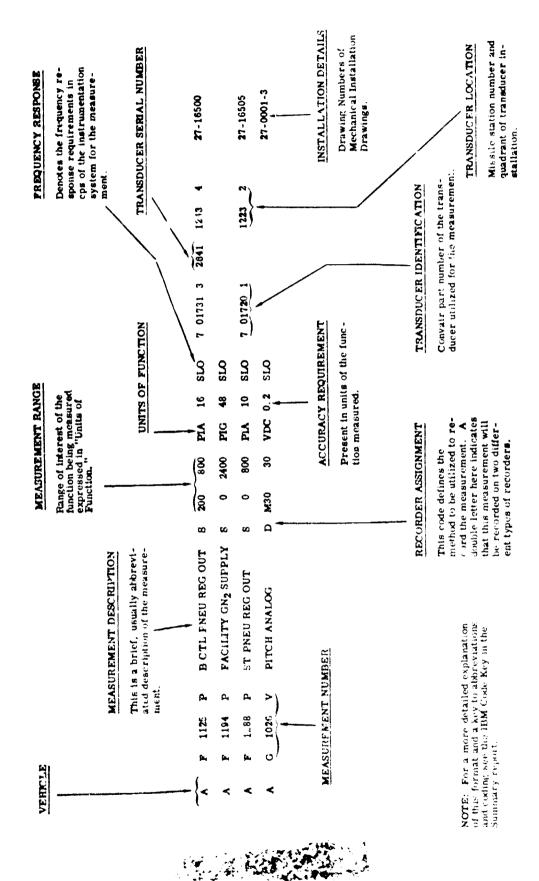
CONVAIR-ASTRONAUTICS

The Landline Instrumentation presented in this section contains the latest available characteristics of the individual measurements. In addition the type of recordings indicated.

LANDLINE INSTRUMENTATION

SECTION 10

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SECTION 10

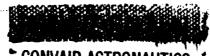
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REPORT NO. AZC-27-059-8

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AZC-27-MISSILE INSTRUMENTATION LOG SHEET 60 SE LANDLINE REPORT NO. PAGE MISSIE (3 ri UNITS FUNCTION TYPE DESCRIPTION ð 1 1517 A ACCELEROMETER Z F1 I 1518 A ACCELEROMETER X F2 I 1519 A ACCELEROMETER Y F2 1 1520 A ACCELEROMETER Z F2 1 1591 C PITCH GYRO TORQUE M75 75 MA 1 1592 CHROLL GYRO TORQUE 1 1593 CH YAW GYRO TORQUE M75 75 MA 20 MIN I 1594 DE PENLULUM #1 NULL MZO MIN 1 1595 D PENDULUM #2 NULL O m20 20 51 M7.5 MIN 1 1595 DI OPTIC SIGNAL 1 1505 H COMPUTER POSITION X 6K 105 ٥ NM 1 1506 H COMPUTER POSITION Y M300 500 10K NM 700 lok 1 1507 H COMPUTER POSITION Z NM 1 1508 H RANGE ERROR FUNCTION 6K NM lok 1 1509 H AZM ERROR FUNCTION M300 0500 10K 1 1502 LI COMPUTER VELOCITY X 22K F/5 10K 4K F/S 10K 1 1503 LI COMPUTER VELOCITY Y 1 1504 L COMPUTER VELOCITY Z 6x | F/S 10K 1 1601 V 400 CPS REFERENCE I 1606 V COMPUTER RESET 10 VOC 15% 450 SEC I 1510 W ELAPSED TIME 0! I 1521 X VERN ENGINE COF SIG OFF OFF 1 1522 X S ENGINE COF SIG 1 1570 X STAGING SIG 1 1603 X WORD GATE FIVE ON OFF I 1604 X MULT GATE SIX ON OFF

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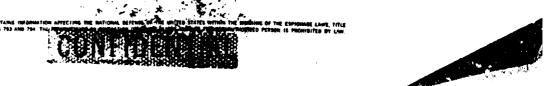




CONVAIR-ASTRONAUTICS

REPORT NO. AZC-27-059-8 SECTION 10

DESCRIPTION		Anissilf_	LANDLINE REPORT NO.	AZ	c-:	27-0	Mizzii	E INSTR	UMEN		ON LO	ဝဋ္ဌ	SHEET 60		_	PAGE		•	5
DESCRIPTION		1 2 1		•	,		III .	•	10	<u> </u>	12	Ш	1)		м			111 11	
		VEHICLE SYSTEM NEASUREMENT NUMBER	3	RECORDER	TRACE	CHARMEL		LANGE	PUNCT.	ACCURACY	BATE OF CHANGE OR FACQUENCY OF FUNCTION		OF	•	1	STATION	T	Ⅲ.	
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SECTION 10



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ABANCIT S133BF	MASSESSED MANAGES	DESCRIPTION	RECORDER	TRACK .	CHANNEL		UEEMENT MOS	UNITS OF FUNCTION	ACCURACY	R OF CHAMES R PROUBACY W PARCHON	TYPS OF TRANSBUCER	SERIAL NO.	STATION NO.	OUABEANT	CASS COSS	DRAW
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5	1118 V	V2 ROL ACTR FEEDBACK		D		M11	11	VAC	5%	30	<u> </u>		 	Н	P	
5	1119 V	VI ROL ACTR FEEDBACK	H	ა		M13	11	VAC	5%	30			 		P	
s	1121 V	GYRO TEST SIG		D		M:		VAC	-1	STP			 		Ρ	
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s	1128 V	B1 YAW ACTR FEEDBACK		٥		M12	12	VAC	5%	30					p	<u> </u>
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VEHICLE SYSTEM CASUREMENT NUMBER MEASUREMENT	DESCRIPTION	RECORDEA TRACK CHANNEL		ir e misi.T	UNITS OF FUNCTION	ACCURACY	FELOUGHCY FRUICTION	TYPE OF	SERIAL NO.	STATION NO.	QUADEANT	CAID CODE	DRA'
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SECTION 10

31 OCTOBER 1960



CONVAIR-ASTRONAUTICS

MISSILE INSTRUMENTATION LOG SHEET

MISSILE SE LANDLENE REPORT NO.	AZC	-27	7-0	59-8		•	D	ATE	31 OCT 60		PAGE_		<u>ე</u>	
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U 1201 X 102 TOPG HI CTL-1	-	R	_	OFF	ON	אסנ	ļ	SIP	<u> </u>			Н	Р	
U 1202 X LO2 TOPG LO CTL-1	\downarrow	R	_	OFF	ON	VDC		SIP			 		Р	
.U 1203 X. LO2 95% RAPID LGAD-1	4	_R		OFF	ON	YDC	<u></u>	SIP	<u> </u>	ļ	 		Р	
U 1204 X FUEL 100% SEC CTL	Ш	R		OFF	ON	VOC	ļ	STP			ļ		P	
U 1205 X FUEL 100% PRI CIL		٩.		OFF	QiL	CCV		SIP				Ш	U	
U 1206 X FUEL 95% SEC CTL		Ř		OFF	OH	VDC		ŞTP				Li	P	
U 1207 X FUEL 95% PRI CTL		R		OFF	ON	VDC		STP				Ш	P	
U 1206 X LOX 100% SLUG COF-2		R		OFF	ON	ADC		STP		<u></u>			II P	
U 1209 XIII LOX TOPS HI C1L-2		R		OFF	ON	VDC		STP					ρ	
U 1210 X LOX TOPG LC CTL-2		R		OFF		VDC		STP					P	
U 1211 X LOX 95% RAPID LOAD-	2	R	,	OFF	1 1	VDC		STP					P	
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BATE 26 Lay 1969

CONVAIR (ASTRONAUTICS) DIVISION GENERAL DYNAMICS CORPORATION

WS-107A-1

INSTRUMENTATION CONFIGURATION

SERIES E ARTICLE 9

AMR

CONVAIR.
ASTRONAUTICS
DEC 29 1960
LIBRARY

PREPARED BY TEST PLANNING

CO-ORDINATED BY

W. S. Becker

APPROVED

H. R. Mscdonald Test Planning

CUTCUTTO BV

T. M. Wooster

Instrumentation

APPROVED BY

P. J. Lynch

Chief - Field Test

Engineering

REPORT AZC-27-059-9 PAGE A 7 December 1960



REVISIONS

NO.	BATE	BY	CHANGE	PAGES AFFECTED
<u>A</u>	7 Dec. 60	WSB	ADDITIONS:	ALL TABS
			F3309D, F1194P, F3301P, F3302P,	
			G302C, G94O, G197O, G587O, G588P,	
			G589P, G281V, I1606V, N3335X,	
			N3336X, N3337X, N3356X, N3932X,	
			N3933X, N1979X, P1020T, P1054T,	
			P709T, P713T, P714T, P1225X, P1226X,	
			P1227X, P1228X, P1229X, P1230X,	
			P1231X, P1785X, S1370X, S1371X,	
			S1372X, S1373X, S1374X, S1375X,	
			S1376X, S1377X, S1378X, S1379X.	
			Reasons for revision "A" changes	4-1
A	7 Dec. 60	WSB	DELETIONS:	
** *			F34P, F65P, F147P, F212P, FM248P,	
			F17T, F146T, I560O, I561O, I564O,	
			I565O, I566O, P1528D, P17T, P18T,	
			P326T, P1017T, P1018T, P1326T,	
			15620	



PAGE NO. 1

Revised 7 DECEMBER 1960

FOREWORD

This report has been published in accordance with contractual requirements as cited in Convair-Astronautics Report ZM-7-289. It describes the instrumentation released for Missile 9-E as of 7 December 1960.

Information presented here will be used by Air Force, Associate Contractors, Design, Operation, and Field Test Groups. Measurement modification will either originate in the Instrumentation Planning Group or will be submitted as a recommendation to this group.

(A)



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PAGE NO. iii

Revised 7 DECEMBER 1960

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SUMMARY	1-1
REASONS FOR REVISION "A" CHANGES	4-1
TABULATIONS	1
Telemetered Measurements by System	8
Telemetered Measurements by Channel	9 (A
Landline Instrumentation	10

THIS MATERIAL CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS, TITLE 18, U.S.C., SECTIONS 783 AND 784, THE TRANSMISSION OR REVELATION OF WHICH IN ANY MANUAL TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW.

PAGE NO. 1-1

26 MAY 1960

SUMMARY

The instrumentation configuration for this missile has been established through a study of program test objectives, systems analysis, and operating considerations. A discussion of missile instrumentation and associated characteristics has been summarized in Report AZC-27-059. For a detailed description of the various missile systems, test objectives, and general test program see Report AZC-27-045.

The specific measurements to be transmitted via telemeter have been tabulated and are listed in Sections 8 and 9 in terms of instrumentation systems and telemeter channel assignments.

In addition to the telemetry, the landline instrumentation program for this missile has been included in this report in the form of a master tabulation of landline measurement characteristics, (Section 10).

To clarify specific measurements, instrumentation location schematics have been included in Report AZC-27-059, Section 7.

PAGE NO. 4-1

Revised 7 DECEMBER 1960

REASONS FOR REVISION "A" CHANGES

I. The following measurements will be used to determine the cause of impact-predictor dropout experienced on the GE-IP system on "D" AIG flights.

MEAS. NO.	DESCRIPTION	CHANNEL
ADD		
G302C	PB-IP MODULATOR AIG	1.11.53
G94O	BOOM ANTENNA	1.C.17, 31
G1970	RB-IP RADIAL	1.C.1, 15
G587O	POD WAVEGUIDE	1.C,33, 47
G588P	WAVE GUIDE PRESSURE 1	1.12.7
G589P	WAVE GUIDE PRESSURE 2	1.12.9
G281V	RB REFLECT SET	1.11.49
DELETE		
1560O	BINNACLE X AXIS	
I561O	BINNACLE Y AXIS	
I562O	BINNACLE Z AXIS	
I564O	COMPUTER X AXIS	
1565O	COMPUTER Y AXIS	
I566O	COMPUTER Z AXIS	

II. The presence of the helium flow measuring orifices in the missile tank pressurization lines interferes with the operation of airborne pneumatic regulators. This phenomena was discovered during 3E FRF.

DELETE	
F34P	FUEL PRESS ORIFIC DP
F65P	LO ₂ TK HE LIN @ORFC
F147P	LO_2^{\sim} PRESS ORFC DP
F212P	FUEL PRESS ORIFIC IN
F146T	LO ₂ PRESS ORFC IN
F17T	FUEL PRESS ORIFIC IN

DELETE

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PAGE NO. 4-2



Revised 7 DECEMBER 1960

III. There is no sustainer LO tank pressurization bottle on series E missiles, therefore the following measurement has been deleted.

MEAS. NO.

DESCRIPTION

CHANNEL

DELETE

FM248P

S TANK HE BOTTLE HI

IV. The following landline measurement provides useful data only during an FRF. Since 9E wil! not be FRF'D, the measurement has been deleted.

DELETE

P1528D

SUS FUET VALVE POS

V. These measurements have been added to determine if proper sequencing of LO₂ slug transfer valves is occurring.

ADD

N3335X	SLG CHG LOX DISCH VLV
N3336X	SLG CHC LOX VENT VLV
N3337X	SLG CHG LOX INLET VI.V
N3356X	SLG CHG LOX LO LEVEL
N3932X	LOX TPNG VLV CLOSED
N3933X	LOX TPNG VLV OPEN
N1979X	PRESS VLV CLOSED

VI. The following measurements were added to provide a record for proof of proper sequence operation of data for failure analysis. These measurements will be made during the integrated systems tests of the autopilot programmer.

ADD

S1370X

STAGING

S1371X

BOOSTER JETTISON

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PAC 10. 4-3

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MEAS. NO.	DESCRIPTION	CHANNEL
ADD		
S1372X	PRESSURIZE VERN TANK	
S1373X	BOOSTER CUTOFF	
S1374X	SUSTAINER CUTOFF	
S1375X	VSHPS BACK-UP SIGNAL	
S ₁ 376X	VERNIER CUTOFF	
S1377X	EJECT RV UMBILICAL	
S1378X	RV JETTISON	
S1379X	FIRE RETROROCKETS	

VII. The following measurement is added to ascertain the adequacy of the ${\rm GN}_2$ supply during countdown and holds.

ADD

F1194P

FACILITY GN2 SUPPLY

VIII. The Latiowing sequence measurements will be used for flight test and systems salidation, by providing time-sequence of operation of these functions during ground checkout.

ADD	
P1225X	ENGINE CONTROL READY
P1226X	PNEUMATICS CUTOFF
P1227X	LOX DOME PURGE
P1228X	IGNITER FUEL PURGE
P1229X	LOX HIGH TOPPING
P1230X	LOX LOW TOPPING
P1231X	LOX 1604 SLUG COM

PAGE NO. 4-4



Revised 7 DECEMBER 1960

IX. The booster lox pump inlet temperature measurements have been added as operational redlines.

MEAS. NO.

DESCRIPTION

CHANNEL

ADD

P1054T

B2 LOX PUMP INLET

P1020T

B1 LOX PUMP INLET

X. This measurement will indicate the number of guidance computer off-on cycles and help to establish the computer run time when combined with measurement I1510W.

ADD

11606V

COMPUTER RESET

XI. The following measurement has been added to validate the booster secondary shutdown system timer.

ADD

P1785X

B SECONDARY SHUTDOWN

XII. Thermocouples installed at the turbine inlets at 1-4E burned off during the first half second of firing. The reliability of the gas generator combustor temperature measurements is much greater and has been demonstrated.

ADD

P709TSGG COMBUSTOR3.11.9P713TB1 GAS GEN COMBUSTOR3.11.5P714TB2 GAS GEN COMBUSTOR3.11.7



PAGE NO. 4-5

Revised 7 DECEMBER 1960

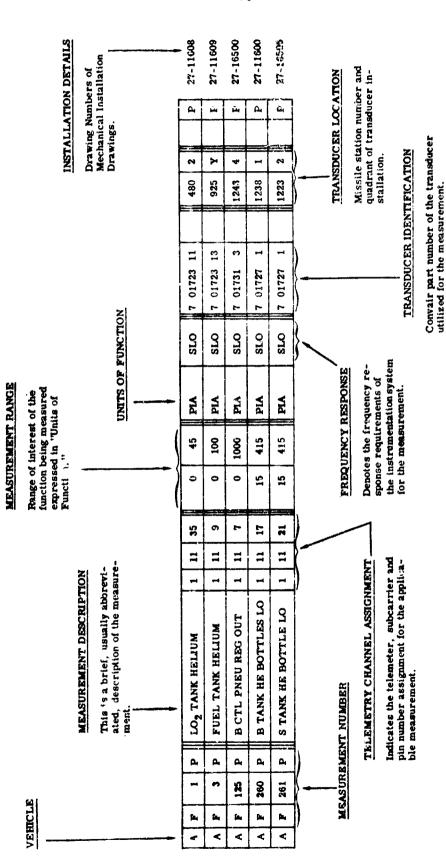
MEAS. NO.	DESCRIPTION	CHANNEL
DELETE		
P17T	B2 TURBINE INLET	
P18T	B1 TURBINE INLET	
P326T	S TURBINE INLET	
P1017T	B2 TURBINE INLET	
P1018T	B1 TURBINE INLET	
P1326T	S TURBINE INLET	

CONVAIR-ASTRONAUTICS

MESSILE INSTRUMENTATION BY SYSTEM

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The Missile instrumentation Log presented in this section contains the latest available characteristics of the individual measurements. In addition, the telemetering channel assignments are included. Note that this section is listed by system.



NOTE: For a more detailed explanation of this format and a key to abbreviations and coding see the IBM Code Key in the Summary report.

Market Ma

SECTION 8

7 December 1960

	MISSILE INSTRUMENTATION LOG SHEET MISSILE P-E REPORT NO. AZC-27-039-9 DATE DATE PAGE 1 THE PROPERTY NO. AZC-27-039-9 DATE DATE THE PAGE 1														<u> </u>					
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В		A				FWD SIDE A FRAME Q4		11		M100		DGF		7		23918	I			27-117 9 3 27-117 9 3
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SECTION 8

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CONVAIR-ASTRONAUTICS

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	VIENCUS TT FEW	MEASUREMENT NAMED IN	* WEASUREMENT	DESCRIPTION	SEMETHE NO.	3	COMMUTATOR FIN NO.	R.	rsmert HS:	CH CHICTICAL	ACCURACY	ATE OF CHANGE ON PEROUBNICY OF PUNCTION		TYPE OF TRANSDUCER		SREIAL NO.	STATION NO.	RANT	CAMP CODE	DRAWING NUMBERS
1	3 1 4	-	+	14 7	10		ВИ	10.4	KAIH D R		4 4		22 10	M# H W M	# 44 44	42 44	W 78	71	77	27-11720
	F	. 3	9 p	BZ THRUST CHAMBER	2	E	11	0	600	PIA		15	7	01731	1	6282	124	2	P	27-11484
	ρ		C P	81 THRUST CHAMBER	2	Ę	9		600	PIA		15	7	01731	1	6141	224	1	P	27-11684
	P		1 P	B1 LOZ INJ MANIFOLD	1	13	39		1000	PIA		SLC	7	0173%	5	4 9	124	. 1	P	27-11684
1	P		2 2	B2 LG2 INJ MANIFOLD	1	13	15	0	1000	PiA		SLO	7	01731		6199	124	2	•	27-11684
	, P	_15	5 P	BI BAS GEN COMBUSTON	1	12	23		1000	PIA		SLO	7	01731		<u> </u>	117	2	•	27-11721
8	₽	_10	4 P	BZ GAS GEN COMBUSTON	1	12	33		1000	PIA		SLO	7	01791		6470	114	2		27-11722
8	P	18	5 P.	81 TURBOPUMP GEARBOX	2	11	49	9	15	PIG		SLO	27	01243	5	16087	117	1	•	27-11721
5	P	15	B P	BZ TURBOPUHP GEARBOX	3	11	51	0	15	PIG		SLO	27	01243	5	15795	114	2	P	27-11722
6		27	9 P	BZ LOZ PR LUB OIL MN	2	11	43	0	125	PIA		SLO	27	01243	9	0041	2144	3	p	27-11722
-	ø	331	9 F	S FUEL PUMP DISCH	2	٤	3	0	1500	PIA		15	7	01731	7	4297	123	1	P	27-11720
-	P	33	7 P	SGG LOZ INJ MAN	1	A	31	0	1000	PIA		SLO	7	01731	5	6562	1235	1	P	27-11720
8	p	34	P	S LUBE DIL MANIFOLD	2	11	47	0	1000	PIA		SLO	7	01731	7	7025	1235	1	•	27-11720
	p	35	P	S LOZ INJ MANIFOLD	1	13	49	0	1000	PIA		SLO	7	01731	5	6623	1235	1	P	27-11720
8	ş	47	3 P	BI LO FR LUB DIL MAN	2	11	45	0	100	PIG		SLO	27	01243	•	0051	2171	1	P	27-11721
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	₽	530	7	S LO2 PUMP INLET	1	11	ų	M300	M270	DGF		SLO	7	01649	11	550	1197	3	P	27-11720
6	P	673	1	TH SECT AMB QUAD 4	1	11	39	M100	300	DGF		SLO	27	01287	3	23916	1222	4	•	27-11793
	P	70	7	SGG COMBUSTOR	2	11	ç	O	1500	DGF		SLO	27	01247	3	94L	1294	4	P	27-11720
	p	711	7	B1 GAS GEN COMBUSTOR	3	11	5	a	1500	DGF		SLO	27	01247	3	89L	1210	2	P	27-11721
	P	714	1	82 GAS GEN COMBUSTOR	3	11	7	o	1500	DGF		SLO	27	01247	3	481	1210	3	P	27-11722
	ρ	347	×	S CUTOFF RELAY	1	13	9	σ	26	VDC		STP							,	
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	3	43	U	YAW DISPL GYRO SIG	1	A	13	M3	3	DEG		5				0015			•	
	5	203	D	B1 PITCH ROLL	1	7		HS	9	JEG		10	7	01680	7	744	1217	2	•	
	s	203		BI PITCH ROLL		1	7	мъ	•	DEG		30	7	01680	7	744	1212	¥	4	27-11721
,	8			82 PITCH ROLL	2	Ę	13	MS	<u> </u>	DEG		10	7	01640	7	764	1212	2	•	
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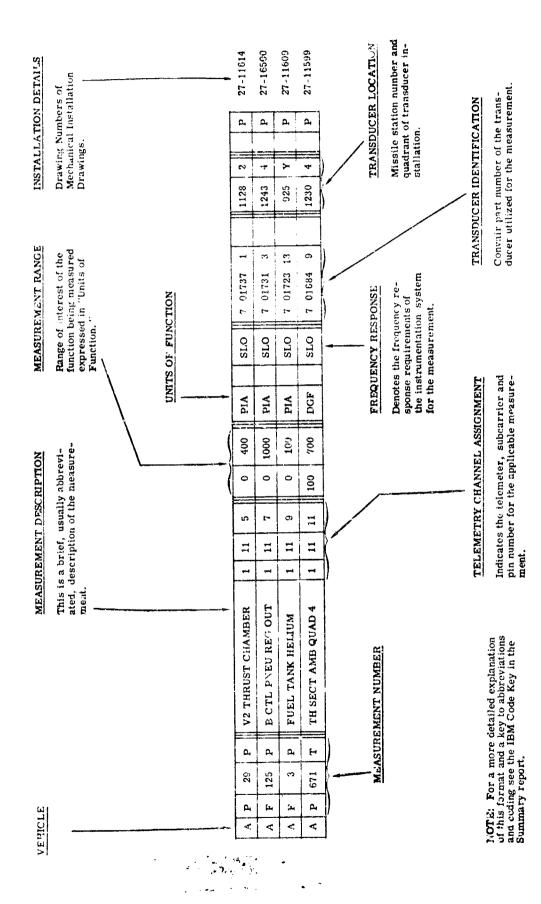
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YEHIOLE SYSTEM MEASUREMEN NUMBER MEASUREMEN		SUSCARRIER NO.		MEASURBMENT NAMBE LOW HIGH	ITHITS ON PUNCTION	ACCURACT TATE OF CHANGE OF PREDUBNICY CA RUNCTION	TTPS OF TRANSDUCES	SERIAL NO.	STATION NO.	CARD CODE	DRAWING MUWASIS
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S 205	B1 YAW	2 1	1 5	H3 5	DEC	30	7 01680	7 740	1212	<u> </u>	27-11721
5 206 [B2 TAN	2 1	19	H5 5	DEG	1 10	7 01680	7 946	1212	2 9	27-11722
5 222 8	V1 PITCH	2 1	E 7	0 50	DEG	10	7 01414	1 07483	1223	P	27-11499
\$ 223 (V2 PITCH	2 !	5	0 50	DEG	10	7 01414	1 10372	1123	2 2	27-11699
8 S 233 S	V1 YAW ROLL	2 8	13	M70 70	DEG	10	27 0:205	1 30CH	1129	12	27-11699
5 234 0	V2 YAW ROLL	2 (17	M70 70	DEG	10	27 01205	3381	1129	2 9	27-11479
S 256 C	SUSTAINER YAN	1, 4	•	M3.0 3.0	DEG		7 01690	769	1210		
S 256 C	SUSTAINER YAW	2 1		M3.0 3.0	DEG		7 01680	769	1210	11	27-11720
S 257 C	SUSTAINER PITCH	1 !	3	M3.0 3.0	DEG	6	7 01686	1159	1210	2 0	
S 257 0	SUSTAINER PITCH	2 11	3	M3.0 3.0	DEG	30	7 01680	11598	1210		27-11720
S 52 R	ROLL RATE GYRO	1 10	,	M8 6	0/5	15		0015			
5 52 R	ROLL RATE GYRO	2 11	13	M8 8	0/5	15		0019		N A	
	PITCH RATE GYRO SIG				0/5			0015		2	
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U eo P	LO2 TANK WEAD	1 13	31	0 5	PID	SLO	27 03280 1	1994P	948 3	•	27-11663
U 81 P	FUEL TANK HEAD	1 13	21	0 5	PID	SLO	27 01286 1	1995	948 3	•	27-12683
U 91 V	ERROR RATIO DEMOD OF	1 A	7	M3 5	VOC	SLO		0004		•	
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SECTION 9 MISSILE INSTRUMENTATION BY CHANNEL

The Missile Instrumentation Log presented in this section contains the latest available characteristics of the individual measurements. In addition, the telemetering channel, assignments are included. Note that this section is listed by channel.





CONVAIR ASTRONAUTICS

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						e G		5	+++	KAN	LSIL/SIL(T	, in	7;	CTOM T	12	14			·	
VIBRICIA	17.1	AL WEST		New Control	DESCRIPTION	STEWE TO	WECARRIE	COMMUNITOR SIE NO.		***	·es	OF PUNCT	ACCURACY.	PERSONAL PROPERTY.	OF TANKSUCER	HO.	STATION NO.	. I	1 1 3	DRAWIM S N. MBÉRI
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0	P		13	B	B2 PUMP SPEED	1	_2	-		680	64 00	RPM		SLO	27 01267 1	16	112	12	Щ	27-11722
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+	\$	25	7	<u>D</u>	SUSTAINER PITCH	1		-	1	13.0	3.0	DEG		. 6	7 01680 3	1199	121	2 2	#1	27-11720
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endere.	STREETS			-	DESCRIPTION	-	- 1	COMMUNICATION AND AND AND AND AND AND AND AND AND AN	MEAST!	- 11	OF PRECTICAL	ACCHARGO	ANT C CHAMBE OR PROPERTY OF PROPERTY	CF TRANSPUORE	SERVAL NO.	STATION NO.	CHARRANT	2 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	DRAWTHS Numbers
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8	A	_4	145	7	AMB FWD 81 Q4	1	13	33	H100	300	D2F	; <u>'</u>	SLU	27 01237	3 5023	119	2	₩.	P 28-11794
L	F	1	247	7	E TANK HE BOTTLES	1	11	33	MACC	M253	Der		5.0	7 01633	5 801	122	4	<u> '</u>	P 27-11682
8	A		141	1	AMB F STG VLV QI	1	1.3	37	HIG	300	DGr	1	SLO	27 01287	3 2334	117	1	1	27-11793
8	P		671	T	TH SECT AND QUAD 4	1	13	39	M100	300	Dar	_	SLO	27 71207	3 2591	122	2 4	<u> </u>	27-11799
-	A		142	7	AMB HEAR B2 GG G3	1	11	42	M2 00	300	061	•	51.0	27 02267	3 5020	119	1 3		P 27-11794
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CONVAIR-ASTRONAUTICS

REPORT NO. AZC-27-059-9A

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MISSILE	REPORT NO.	AZC	- 2	7-d	W.Z.A.E	INSTRU 	MENT	ATIO D	n log	39HEEE 60-		PAGE		3	
1 2 1 4		• }	7	•	,		10	H	12	13	и	198	76	"	
ACCOUNTS AND ACCOU	DESCRIPTION	THEMETER NO.	SUB-CARRIER	COMMUTATOR PSN INO.	100	HIOH	OF PRINCINGS	AUCURACT	AATE OF CHANGE OR PERCENCE OF PARCTICAL	TYPE OF TRANSPIRATE	SETURE.	STATICH NO.	3	CARS COOR	PZĄWIN O NUM OR S
8 4 8 3 9					3 3	7 4	-	-	***	DR MFYDM BON] AF 70	1	+	
	COMMO RATE 5 RPS	1	12	0					<u>'</u>			 	+		
e 1 591 °	GYRO 1	1	12	1	M6.3	5.3	DGC		SLO		ļ		igwdap	P	
# 1 532 T	GARO S	1	12	3	M6.3	6.3	DGC		SLO			<u> </u>	$\downarrow \downarrow$	P	
1 533 T	BINNACLE	1	12		**	106	DGC		5LO			<u> </u>		P	
3 388 P	WAVE GUIDE PRESS 1	1	12	7	0	15	PIA		340	7 61225 1		<u></u>	Ц	P	
G 589 ?	WAVESUIDE PRESS 2	1	. 2	9	0	15	PIA		SLO	7 01225 ì				9	
# 1 540 V	CONTROL 118 PHASE B	1	12	11	O	130	VDC		SLO					P	
1 534 T	AMALOG 518 CONVERTER	1	12	13	0	100	DGC		3LO					ρ	!
	BINNACLE			15			PIA		SLO				1	P	: •
	S CTL HE BTL DISCH			17	1				LO	7 01720 5	4314	1213	2	P	27-11650
	COMPUTER	1		19	 				SLO					P	;
1-1	CONTROL M22.5 PSUP			1	1				SLO				П	6	ł
[21	+		1				4050	4194		H	27-11735
β 155 F	51 GAS GEN COMBUSTON					1000	PIA		SLO	7 01731 5	5033	1173	1 1	H	27~11721
	1905 CALIB	1	12	25	 			<u> </u>	├ ──┼			₩	H	Н	
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	SON CALIB	1	12	29	 			<u> </u>				 	\vdash		ſ
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P 184 P	82 GAS GEN COMBUSTON	1	1.2	33	0	1000	PIA		SLO	7 01731 5	6470	1144	3	P	27-11722
0 7 527 X	PRE-ARM RELAY CLOS	1	12	35	OFF	ON	<u> </u>		STP			 		P	
P 529 D	S MAIN LOZ VLV	1	12	37	0	90	DEG		SLO	NAA		1205	3	P	27-17564
I 544 V	COMPUTER M16.5 PSUP	2	12	39	M20	9	\ \ -	-	SLO					р	
1 548 V	COMPUTER 38 PSUP	1	12	41	0	42	VO.		SLO					P	
H 33 P	B1 AYD ACCUMULATOR			43		3500			SLO	1	5143	1173	1	P	27-11721
	PRE-ARM SIGNAL 1			Τ	OFF	ON			STP			<u> </u>		P	
	PPT-ARM SIGNAL 2	П		1	OFF	ON	-		STP						
							#	 			-		$\dagger \dagger$		
	STAGING SIGNAL	1		49	1	ON	#	<u> </u>	STP		 	-	\dagger		
	YERM ENGINE COF SIG	1				ON	 -		STP	 	 	 	-	۲,	
<u> </u>	S ENGINE COF SIG	++		49	#	ON	1		STP	 			-	1	
1 +	SUS/VERN HYD PRESS	 		51	+	3500	PIA		SLO	7 01720 9	5089	1211	2	P]
P 246 P	B TANK HE BOTTLES HE	1	12	53	0	3500	PIA	\	SLO	7 01720 5	5634	1181	•	∦ P	27-11662
	SYNC & 1005 CALIB	1	12	55	-		-			<u> </u>	<u> </u>	 		\parallel	
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		9		·	7			•	10	11	12	10	Н	1 4	[6]	10	
		MAN MEANING	DESCRIPTION	TRANSPORT NO.	S C	COMMENTANCE PRE 180.	LOW	REPORT HEE	SWETTS OF PERCTION	ACCHING	AATS OF CHARGE OF PRECEDENT OF PRECEDOR	OF TRANSPUCES	SSMAR. MG.	STATIGN: MQ.	Sentante	2800 6773	CEASTING
8 4 3		-	10 17	=	20	S M	28 26	# 4	• •	4 0	# #	20 40470 64		0 N	3	79	
1			COMM. RATE 5 RPS	1	11	0	-	-	₩		ļ		<u> </u>	ļ	Ц		
				1	11	1											
	248	X	A/P PS SWITCH 17	1	13		OFF	OH	VDC		STP					P	
P	548	X	COMPLETE COF RELAY	1	13	9	0	28	VDC		STP			<u> </u>	Ц	P	
D	_1	٧	RSC CUTOFF OUTPUT	L	11	7	0	31	VDC		STP					•	
	947	X	S CUTOFF RELAY	1	19	9	0	28	VDC		STP					P	
E	28	٧	MSL SYSTEMS INPUT	1	13	11	0	30	VDC		SLO	·	0004			P	
P	36	P	VERNIER LOZ TANK	1	13	13	0	1000	PIA		SLO	7 01720	3 3544	1208	1	P	27-11651
P	92	P	82 LOZ INJ HANIFOLD	1	13	15	0	1000	PIA		SLO	7 01731	5 6199	1244	2	P	27-11684
P	56	P	S LOZ PUMP INLET	1	13	17	0	150	PEA		SLO	27 01243	9 0045F	1235	1	P	27-11720
				1	12	19											
U	81	P	FUEL TANK HEAD	П		21	11	5	PID		SLO	27 01280	1 1995P	948	3	P	27-11683
E		-#	400 CYCLE AC PHASE C	-	1-	1	#		#	†	SLO		0004	 		ρ	
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			OS CALIS	!		27	1								\sqcap		
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U	50	71	LOZ TANK HEAD			31	П	5	PID	_	SLO	27 01280	1 1994P	948	1	۱,	27-11462
P	1	-#	LO2 TANK HELIUM	Н	-	33	 		#		SLO				1	!	
		7				35	11		1		-					H.	21 33019
F			FUEL TANK HELIUM			37	 	100	PIA	<u> </u>	SLO	7 01723 1	5 6349				39_114.03
P									1			i		948	\Box		
		П	61 LO2 INJ MANIFOLD			39	11	1000	1		SLO		5 ₩ 9	1244	1		27-11484
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			LO2 PRESS REG INLET			1 1	#	3000	<u> </u>		SLO		j	1187		H_{1}^{-}	
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	1 2	3 4	5	•	,			•	10	1)	12		13		4		*		
	VEHICLE	3	DESCRIPTION	TELEMETTE NO.	SUBCARRIER	COMMUTATOR PIR NO.	EA	R\$M3MT NGE HIGH	UNITA OF AUNICINOR	ACCULACY	LATE OF CHANGE OR PERCHANCE OF PERCHON	11	TYPE OF TRANSOUCES		SERIAL NO.	STATION NO.	Ш	248 COSE	DEASTING NUMBERS
1	1 4	,	16 29		11 12	23 M	× ×	30 40	4 4	* *		-	HEFRE	***	•	# N	1~	-	
- 1			COMM. RATE 10 RPS	1	A	0						Ш				 	Ш	Ш	
	E	51 \	400 CYCLE AC PHASE A	1	Ą	1	105	125	VAC		SLO	<u> </u>			0004	 	Ц	P	
В	н	225 F	B TK RESVR GAS.	1	A	3	0	200	PIG		SLO	27	01243	7	15916	1174	4	2	27-11815
ĺ	D		#1 RSC RF INPUT/AGC	1	_ ^	5	15	100K	UV		SLO	<u> </u>			124	 .		,	
Ī	U	91 \	ERROR RATIO DEMUS OP	1	A	7	HS	5	VDC		SLO	╙			0004	 	Ц	Ŀ	
	5	61 0	ROLL DISPL GYRO SIG	1	A	9	М3	3	DEG		5	 			0015	<u> -:-</u>	\sqcup	٩	
	S	62	PITCH DISPL GYRO SIG	1	A	11	M3	3	DEG		5	Ш_			0015	 		P	
	S	63 0	YAW DISPL GYRO SIG	1	A	13	нз	3	DEG		5	 	·		0015	 		P	
8	н	227 X	S TK RESVR PISTON	1	A	15	ON	OFF				87	44900	109		1160	٥	P	27-86209
	Z		XPONDR RF INPUT/AGC	1	A	17	M120	0	рви		3	Ì			211				
	Y	1 ×		1	A			ON	MC		STP							P	
В	н	315 F	SUS HYD LO PRES	1	A	21	0	200	PIG		SLO	27	01243	11	15394	1200	3	7	27-17570
-	М		CONAX VALVE COMMAND	1	A	23	OFF	ON			572							•	
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ľ	- - -		50% CALIB	1	A	29													
	Р	337 P	SGG LO2 INJ MAN	1	A	31	0	1000	PIA		SLO	7	01731	5	6562	1235	1	F	27-11720
-	P	28 P	V1 THRUST CHAMBER	1	A	33	0	400	PIA		SLO	7	01737	3	1517	1127	4		27-11699
	ρ		V2 THRUST CHAMBER	1	٨	35	0	460	PIA		SLO	7	01737	3	1367	1127	2	•	27-11699
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	S	61 C	CONNECTED TO 1 A 9	1	A	39											Ц	Ш	
	S	62 0	CONNECTED TO 1 A 11	1	A	41													
	5	63 C	CONNECTED TO 1 A 13	1	A	43												Ш	
ľ	ρ	528 C	S MAIN FUEL VALVE	1	A	45	0	90	DEG		SLO		NAA					2	
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				TWE SECONDARIOUS	DESCRIPTION	· CH WARREN	MESCARDIRE NO.	COMMENT!/ TOR	#	9 8/4/9017 HOS	Co reschoes st	ACCELACT	DATE OF CAMPRIES OF PREC'ACON	TYPE SELAL NO. TRANSDUCES	FATION NO.	DEVENTED 2	CAMB COOM	ERAMINOS HIZMAGONS
L	+	+	1 1	•	CONN. RATE 1/8 RPS	*		N CE	* *	D C	40 40	4 4	4 6		# 18	71	70	1
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SECTION S

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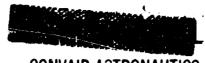
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WENCLE	MANES MANES PEASUREMENT	DESCRIPTION	BATTER INC.	WACAZINES NO.	+	MEA	EURÉMENT LANGE	UNHTS	ACCUEACY	OF CHAMBE PROPERCY PURCHON	TYPE OF	SSRIAL NO.	STATION NO.	E	CARS COSE	DRAWING NUM'2881
	3 E		£	•	i .	FOM	HIGH	8	1	282	TRANSDUCER				3	
3 4 1	2 9	10 27	30	31 2	20 14	8 1	3 77 48	4 4	4 4	49 81			Ø 70	71	10	
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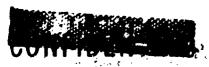
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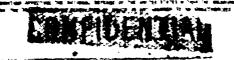


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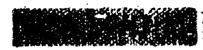
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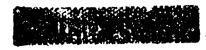


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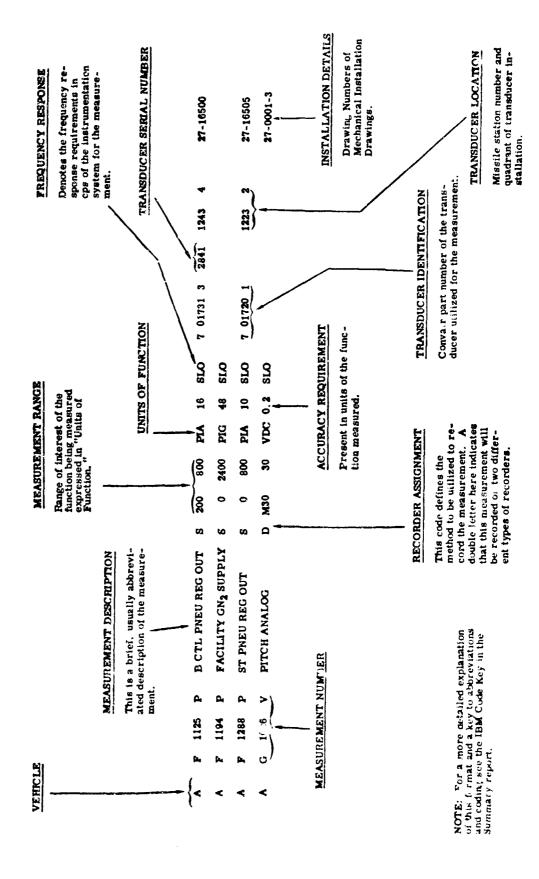
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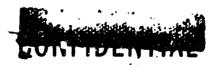
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SECTION 1

LANDLINE INSTRUMENTATION

The Landline Instrumentation presented in this section contains the latest available characteristics of the individual measurements. In addition the type of recordings indicated.



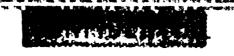


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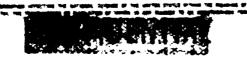
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1	STAGE	WEASURESERT .	E MEASUREMENT		DESCRIPTION	E.	TRACK	ہی	MBA	NRELIEST ANGE		OF PUNCTION		OF PRICEDOR	TYPE OF TRANSONCER	SSMAL NO.	STATION HO.	Ę	1	98AN
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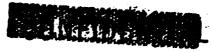


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	į	-	•	-	DESCRIPTION	RECORDER	CHAMMEL		1484311 M44	OF PRESCRICAL	ACCORAGO	AATS OF COLUMNAS OF PRECISORS OF PRECISORS	TIVE OF TRANSBUCES	CONLAL ING.	STATION NO.		300 973	98AW/
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	9	16	LO		FUEL TANK HELTIM	_	۵		75	PIG		SLO	27 01243	7 10115	948	1		27-1168
_	8	M	10.1	P	FUEL TANK HELTUM		M	<u> </u>	79	PIG			27 01241	7 00118	948	1		27-1148
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	1	15	43	5	YAM EYRO TORQUE			479	75	NA.				~	······································			
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SYSTEM SALUEBEENT NUMBER NACASUREMENT	DESCRIPTION	RECORDER	TRACK	CHAMEL		MBE	VANTS P PUNCTION	ACCHENCY	PROCHOSECY PRECTION		rws or	MO.	SEARGE MO.	PRACTICAL	AMB 0086	88A4
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M	133	X	\parallel	SLE OH LOZ INLET VLV	_	R		OPEN	CLOS			SLO			II		P	
M	333	X		SLG CH LOZ INLET VLV		R		OFF	ON		<u> </u>	STP					P	
M	1330	×		SLE CH LN2 INLET VLV		R		OPEN	CLOS			SLO				Ц	P	
N	1335	×		SLG CH GNZ INLET YLY		R		OPEN	CLOS			SLO	li				•	
×	3350	×		SLG CH LOZ LOW LEVEL		R		OFF	ON			STP					P	
N	393	X		LOZ TPNG VLV CLOSED		R		OFF	ON			STP				j	,	
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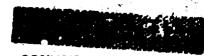
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VEHICLE		HUNEL ?	MEASUREMENT	DESCRIPTION:	RECORDER	TSACK	CHAIMEL.		#3M8M7 #85	WHITS F PUNCTION	ACCURACY	PEROVENCY PEROVENCY PERICHON	or or	988AL 110.	STATION NO.	Bernera	CAMB CAMP	•
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_ 2	1	020	T	81 LOX PUMP INLET	-	_ 5		#325	r.275	DGI	ــــــــا	SLO	7.016499		1182	4		27-11
	1	054	7	82 LOX PUNP INLET		s		M325	M275	DGI		SLO	7 01642		1289	2		27-11
P	٠	125	ī	ENG COMP AMRIENT		S		M130	500	Det		SLO	7 01484 5		1208	1		27-11
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┦┛	12	30	×	LOZ LOW TOPPING	4	R		OFF	ON	VDC		STP						
و	12	31	×	LOZ 100% SLUG COM	\perp	•	_	OFF	Om	VDC		STP						
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P	15	49	X	IGNITION START	4	R	-	OFF	OH	VDC		SIP				4	P	
P	17	85	X	B SECONDARY SHUTDOWN		R		OFF	ON	VOC		STP					•	
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CONVAIR-ASTRONAUTICS

MISSILE INSTRUMENTATION LOG SHEET

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SECTION 10

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SECTION 10

7 December 1960

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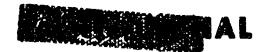
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7 December 1360

CONVAIR-ASTRONAUTICS

MISSILE INSTRUMENTATION LOG SHEET

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3 1207 X FUEL 959 PRI CTL	R	OFF	ON	VDC	SIP		ļ	ļ. 		2	
U 1208 X LO2 100% SLUG COF-2	a	DFF	QN	VDC	SIP		ļ	ij		P	
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CONVAIR (ASTRONAUTICS) DIVISION GENERAL DYNAMICS CORPORATION

WS-107A-1

INSTRUMENTATION CONFIGURATION

SERIES E ARTICLE 12

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CONVAIR-ASTRONAUTICS MAR 9 1961

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CO-ORDINATED BY WS Bocker

W. S. Becker

APPROVED B

H. R. Macdonald

Test Planning

CHECKED BY

T. M. Wooster

Ownatrumentation

APPROVED BY

P. J. Lynch

Chief - Field Test

Engineering

GD

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			A438T, A440T, G940, G1970, G5870,	
			G588P, G589P, G281V, G302C, H52P,	
			H130P, , H185P, , H212P.	
vy			H219P, H379P, H398P, H1360P, H383R,	
			H384R, H385R, H386R, H387X, H388X,	
			H389X, H1187X, H1188X, 11606V.	
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			L1448D, L1449D, P1225X, P1226X, P1227X,	
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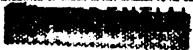
REPORT NO. AZC-27-059-12 PAGE NO. 1 21 FEBRUARY 1961

FOREWORD

This report has been published in accordance with contractual requirements as cited in Convair-Astronautics Report ZM-7-289. It describes the instrumentation release for Missile 12-E as of 21 February 1961.

Information presented here will be as a by Air Force, Associate Contractors, Design, Operation, and Field Test Groups. Measurement modification will either originate in the Instrumentation Section of the Test Planning Group or will be submitted as a recommendation to this group.

THIS MATERIAL CONTAINS IMPOPMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE EXPLORAGE LAWS, TITLE 18, U.S.C., SECTIONS 793 AND 794, THE TRANSMISSION OR REVELATION OF WHICH IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW.



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SUMMARY

The instrumentation configuration for this missite has been established through a study of program test objectives, systems analysis, and operating considerations. A discussion of missile instrumentation and associated characteristics has been summarized in Report AZC 27,009. For a detailed description of the various missile systems, test objectives, and general test program see Report AE60,0430.

The specific measurements to be transmitted via telemeter have been tabulated and are listed in Sections 8 and 9 in terms of instrumentation systems and telemet in channel assignments

In addition to the telemetry—the landline instrumentation program for this missile has been included in this report in the form of a master tabulation of landline measurement characteristics—(Section 10)

To clarify specific measurements, instrumentation location schematics have been included in Report AZC 47 059, Section 7

There are a total of 180 telemetered measurements on 41 channels in this missile divided as follows

	ACCEL	DEFL	SOd	PRES	TEMP	VOLT	DIS. POS	MISC	TOTAL
A/FRM				1	15			2	18
PNEU			2	9	4				13
GciD			,	2		3		6	11
HYD				12			4	4	20
INER GUID	6	4	, ;	l	5	11	8	õ	45
PROP	l	2		∠ 0	4		3	3	33
A. P. SYS		13			• •• 1		1	3	17
MISC			0.2			6	9	6	23
TOTAL	7	19	; 7	4 5	28	20	26	29	180

There are also 239 measurements recorded and displayed via 239 landline channels.

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21 FEBRUARY 1961

REASONS FOR REVISION "A" CHANGES

INTRODUCTION

Due to the inflight failures of missiles 3E, 4E, and 8E, additional instrumentation has also theen added to missile λ E to continue the evaluation of the airborne hydraulic system, effects of radiant heating, and aerodynamic heating of $V \times$ electrical components

The bracket which mounts the sustainer engine control package to the engine has been strengthered by Rocketdyne to preclude any inflight failures. Break wires attached to the sustainer extend package (H387X, H388X) and main hydraulic distribution manifold (H389X) will indicate mounting bracket failures. A measurement recommended by Rocketdyne for analysis of the sustainer engine control package performance has also been added. Accumulator gas pressure (H398P)

Measurements of flow to the sustainer engine control (H384R), to the high pressure distribution manifold (H386R), to the hydraulic reservoir via the high pressure relief valve (H38°R), and from the termer distribution manifold (H385R) will provide data on over this system performance as well as isolate the location of a failure in the high pressure portion of the system. A low pressure measurement in the vernier return line (H*12P) in conjunction with the Hydraulic Pumping Unit Sustainer Return (H1360P) pressure will provide additional data for a pressure survey in this area of the system. Data for maifunction analysis of the high pressure system will also be provided by pump discharge [H130P), main system accumulator (H52P) and line (H191P) pressure measurements.

A check saile has been installed in the sustainer high pressure line upstream of the staging disconnect. This will prevent loss of hydraulic fluid in the event that the disconnect couplings become damaged. A pressure measurement located between the check value and the rise-off disconnect (H379P) will provide data on proper sealing and structural integrity of the disconnect coupling. A heat shield has been added over the rise off disconnect panel and sliding poppets have been added to the disconnects the nselves to protect them from radiant heating. A thermocouple (A6T) will be located between the disconnect heat shield and disconnect panel to measure ambient inflight temperatures.

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In addition to the foregoing, measurements (H140P) Sustainer/Vernier Hydraulic Pressure, and (H219P) Sustainer Tank Reservoir Gas Pressure, and (H185P) Sustainer Hydraulic Pump Inlet Pressure will also be installed. These measurements were planned for previously as part of the over-all instrumentation package for missile 12E. (See Figure 1.)

Sequence measurements in the Hydraulic Pumping Unit will provide data on booster (H1187X) and Sustainer (H1188X) system hydraulic fluid evacuation (see figure 1). Information on missile tilt or roll at rise off will be provided by displacement measurements at Quadrant I (L1446D) II (L1447D), III (L1448D) and IV (L1449D) (see figure 2). The extensiometers are located on the upper pedestal supports on the launcher.

II. In addition to the thermocouples, three (3) calorimeters have been placed on the aft heat shield on 12E. See Figure 2 for app oximate locations:

A412T BLACK CALOR QIV A438T 38 GM CALOR QIV A440T 19 GM CALOR QIV

The calorimeters are clustered in groups of three to give the heat transfer coefficient along with readings of convection and radiation quantities. The 19 gram gold calorimeter provides a measure of convection heat while the black calorimeter will provide total heating information. The third calorimeter in the group, 38 grams, combined with the other two calorimeters will give the heat transfer coefficient. All calorimeters are mounted facing aft and approximately 3 inches in diameter for each calorimeter.

Due to the danger of soot or other elements plating the surface of the relatively large calorimeter clusters during launch period and producing incorrect data, two nine (9) inch pie tins will be placed over the clusters as covers. The pie tins will be mechanically removed after the first ten (10) feet of flight. Camera coverage will substantiate the successful removal of the two pie tins.

III. High temperatures in the conduit, electrical connectors, and the fairings around the vernier engines have been considered as a possible cause for short circuiting. To



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mediately difference the inflight temperature environment at these locations the following measurements will be made on 32k.

- ATT VC FAIRING AMBIENT (Inside)
- A21 V. CLAMSHELL AMBIENT (Inside)
- 331 V2 CONDUIT (Near Center) and
- A4 (V.) SERVO ELECTRICAL CONNECTOR (Surface)

chermal approval be a combination of aerodynamics length plume and electrical connect of beating. The chamsbell fairing, mounted on the side of the vernier engine has so as a large openings which facilitate gimbating. Measurement of the clamsbell rate for the same (AoP) will be made to investigate what effect "ram air" entering into this fairing may have on its environment.

temperatures of thermocouple reference junctions (T2T T3T T103T T162T) will be made to insure accurate date from all thermocouples. These reference junctions are used with measurements made on the booster sustainer and vernier engine areas as specially.

1: provide higher quality data during the critical portions of burch, and supply booster crisine reigh combission data for the first Vefect of missile trave. 2 accelerometer pressurements will be monitored our trailing wire umbilical.

MEAS

DE. CRIPTION

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BI NAA RCC ACCEL

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PAGE NO. 5-4

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VI. The booster LOX pump inlet temperature measurements have been added as operational radiines.

MEAS

DESCRIPTION

ADD

P1020 7

BI LOX PUMP INLET

P1054T

8? LOX PUMP INLET

Vii. This measurement will indicate the number of guidance computer off-on cycles and help to establish the computer run time when combined with measurement II510W.

ADD

I1606V

COMPUTER RESET

VIII. The following sequence measurements will be used for flight test and systems validation, by providing time-sequence of operation of these functions during ground checkout.

ADD

⊃1225X

ENGINE CONTROL READY

P1226X

PNEUMATICS CUTOFF

P...27X

LO, DOME PURGE

P1228X

IGN.TER FUEL PURGE

P1229X

LOS HIGH TOPPING

P123.5X

LO, LOW TOPPING

P1231X

1009 SLUG COM

The following measurements were added to provide a record for proof of proper sequence operation or data for failure analysis. These measurements will be made during the miegrated Systems Test of the A.F. programmer.

ADD

51370X

STAGING

S1371X

BOOSTER JETTISON



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MEAS	DESCRIPTION	CHANNEL
ADD		
S1 7. X	PRESSURIZE	
S1373X	BOOSTER CUTOFF	
S1374X	SUSTAINER COTOFF	
$\mathbf{SUC}_{\mathbf{F}}\mathbf{X}$	VSHP\$ BACK-UP SIGNAL	
S1376X	VERNIER CUTOFF	
S1377X	EJECT RV UMBILICAL	
S1375X	RV JET HSON	
S1379X	FIRE RETRO ROCKETS	

X The following measurements will be used to determine the cause of impact Predictor drop out experienced on the $G/E \otimes P$ system on "D" AIG flights

4DD		
GASIV	RB REFLECT SEA	1 11 49
(30 C	PB-JP MODULATOR AVG	1 11 53
G555P	WAVEGUIDE PRESS 1	1 12 7
G_{2} 88	WAVEGUIDE PRESS 2	1 12 9
G1970	RB IP RADIAL	1 C 1 thru 15
Gaid	BOOM ANTENNA	1 C 17 thru 31
G557()	POD WAVEGUIDE	1 C 33 thru 47

The flight readlines—tiring (FRF) on Missile 12E has been replaced by a flight readiness denotes traiter (FRD). The FRD concept proceeds through the countdown up to T is seconds at which time the rest is terminated. The landline instrumentation requirements are their tore modified as follows:

DELETE

PlateP	BULUBE OIL INJ MAN
$\mathbf{p} \cup \{1,\mathbf{p}\} =$	BALLUBE OIL ING MAN
P1232P	S LO SEAL CAVITY
P146aF	S LO PROIL MAN
Pilasi	SGG COMBUSTOR

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CONTRIBUTION CONVAIR-ASTRONAUTICS

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DESCRIPTION
B1 GAS GEN COMBUSTOR
B2 GAS GEN COMBUSTOR
B1 TBN OVRSPEED TRIP
B2 TBN OVRSPEED TRIP
B1 ROUGH COMB COT
B2 ROUGH COMB COF
S ROUGH COMB COF
S TEN OVRSPEED TRIP
S RCC BINARY COUNTER
B1 RCC BINARY COUNTER
B2 RCC BINARY COUNTER

XII. There is no sustainer LOX tank pressurization bottle on E series missiles, therefore the following measurement has been deleted.

DELETE

FM248P

S TANK HE BOTTLE HI

XIII. Complexity prohibits making or calibrating this measurement in a way that will yield valuable data for test evaluation.

DELETE

ZZE

KLYSTRON PWR OUTPUT

XIV. Upon reevaluation by Arma, these measurements will not provide the data originally required. Therefore they are deleted.

DELETE

I1603X

WORD GATE FIVE

11604X

MULT GATE SIX

11605X

112 CPS GATE

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XV. Measurement H315P has been deleted because it is a duplication of the new measurement H185P.

XVI. These measurements have been deleted to provide channel space for hydraulic incrumentation

MEAS

DESCRIPTION

DELETE

P798A

LOX LINE AXIAL ACCEL

P671T

TH SECTION AMB QUAD 4

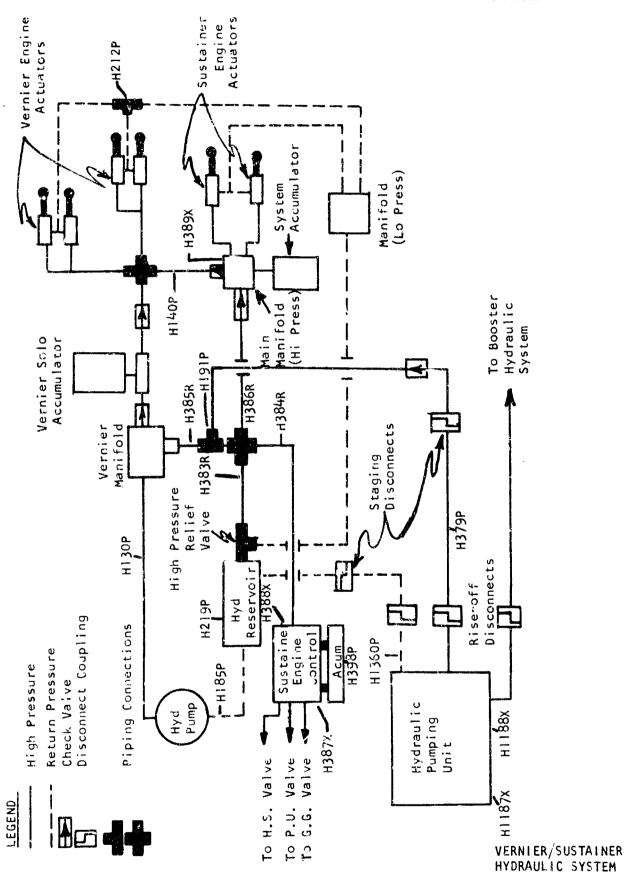


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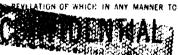
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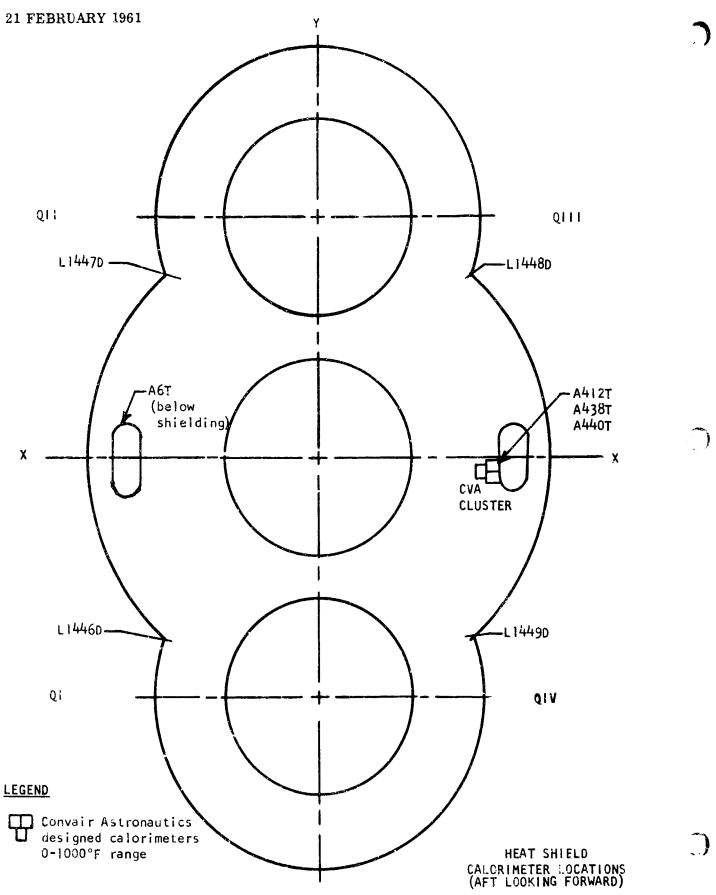
THIS MATERIAL CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS, TITLE 18 U.S.C., SECTIONS 793 AND 794, THE TRANSMISSION SERVITATION OF WHICH IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW



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THIS MATERIAL CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIGNAGE LAWS, TITLE 18, U.S.C., SECTIONS 793 AND 794, THE TRANSMISSION OF THE STATES OF THE UNITED BY LAW

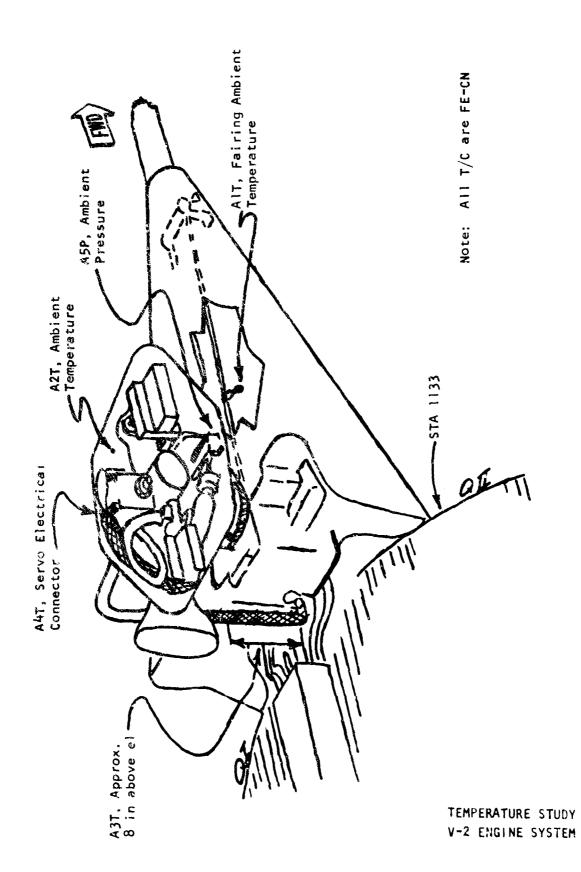


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CONVAIR-ASTRONAUTICS

The Missile Instrumentation Log presented in this section contains the latest available characteristics of the individual measurements. In addition, the telemetering channel assignments are included. Pinke that this section is listed by system.

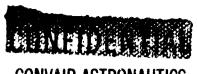
MISSILE INSTRUMENTATION BY SYSTEM

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27-11600 27-11608 27-11609 27-16500 27-16505 INSTALLATION DETAILS Dra ving Numbers of Mechanical Installation Drawings. Missile station number and quadrant of transduct in-TRANSDUCER LOCATION ۵, o, ۵, Q, Convair part number of the transducer utilized for the measurement. TRANSDUCER IDENTIFICATION stallation. 1223 1243 1238 4.80 935 7 01723 11 5 7 01723 7 01731 7 01727 7 61727 UNITS OF FUNCTION 810 816 **918** SLO 918 Denotes the frequency response requirements of the instrumentation system for the measurement. PPEDUENCY RESPONSE Range of interest of the function being measured expressed in 'Units of Function." MEASUREMENT RANGE Y d M P!A PIA Z 415 1000 3 415 **\$** 0 15 9 6 2 = S 11 Ξ = Indicates the telemeter, subcarrier and TF' RAIRY CHANNEL ASSIGNMENT pin number assignment for the applica-ble measurement. This is a brief, usually abbrevi-ated, description of the measure-ment. MEASUREMENT DESCRIPTION B TANK HE BOTTLES 1.0 8 TANK HE BOTTLE LO B CTL PNEU REG OUT FUEL TANK HELIUM LO2 TANK HELLUM MEASUREMENT NUMBER ۵, Δ, ۵ ۵, ۵, 260 Ħ 36 VEHICLE þ,

NOTE: For a more detailed explanation of this formal and a key to abbrevisious and coding see the IBM Code Key in the Summary report.

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MISSILE INSTRUMENTATION LOG SHEET

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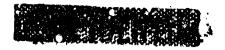
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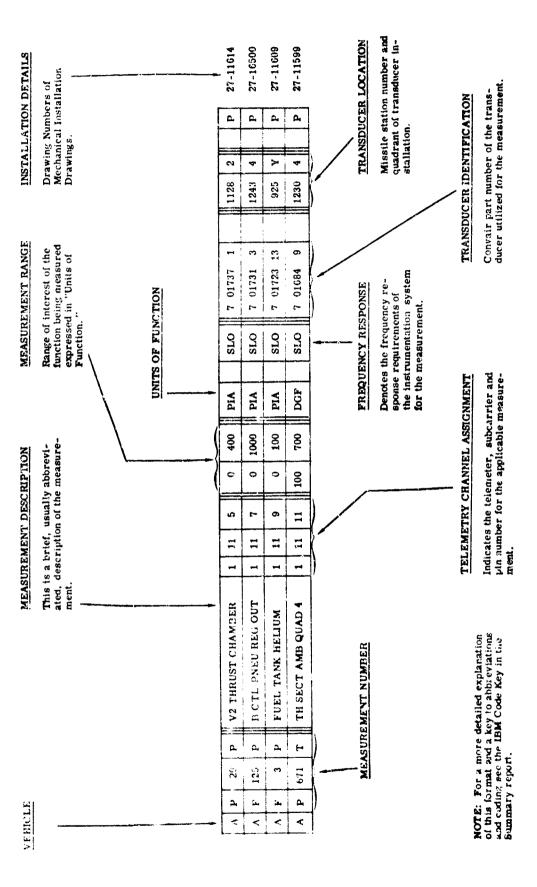
うとの政治等別の教育、大学の内容を考えば対し、主要を主任者の大学を重要を明確ないない。これの教育の教育を言うでは大学の大学を主義の教育を言う

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MISSILE INSTRUMENTATION BY CHANNEL

SECTION 9

The Missile Instrumentation Log presented in this section contains the latest available characteristics of the individual measurements. In addition, the telemetering channel assignments are included. Note that this section is listed by channel.



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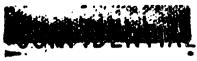
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MISSILE INSTRUMENTATION LOG SHEET REPORT NO. AZC-27-059-12 MISSILE 12E P/GE COMMUTATO FIN NO DESCRIPTION NUMBERSCOMM. RATE 5 RPS ,1.12.01.12. 1...M6.3. 6.3...DGC. ...SLO... .1. 531.T...GYRO 1 1.12. 3.11M6.3. 6.3...DGCSLO... ● 1. 532.T...GYRO 2 .1.12. 5... 0. 100. DGC. SLO .1. 533:T BINNACLE 0. 15 PIA SLO 7 01225 27-11883 .G. 588.P...WAVEGUIDE PRESS 1 .1.12. 7... 27-11883 G 589 P MAYEGUIDE PRESS 2 .1 12. 9... 0. 15 PIA. SLO 7 01225 0. 130 VDC 1 - 540 V ... CONTROL 115 PHASE 8 -1-12-111. 534.1...ANALOG SIG CONVERTER 1.12.13... 0. 100...DGCSLO.... 1 12 15 0. 41 PIA. SLO .I. 572 P ... BINNACLE F. 145 P. S CTL HE BTL DISCH. 1 12 17. 0 3500 PIA 175 SLO. 7 01720 5 5457 27-11650 1 12 19 0' 50 DGC .1 535 I ... COMPUTER I. 541 V .. CONTROL M22.5 PSUP 1.12.21 0 25 VDC F. 155 P. B1 GAS GEN COMBUSTOR 1 12:23 0 1000 PIA 25 SLO 27-11721 100% CALIB 1.12.25 1.12 27 .1.12.29... 50% CALIB R H 398 P. NAA HYD ACCUM JAS 1 12 31 0 3500 PIA 58 SLO 7 01720 P 184 P 82 GAS GEN COMBUSTON 1 12 33 0 1000 PIA 25 SLO 7 01731 1 527 X PRE-ARM RELAY CLOS 1 12 35 OFF ON STP P. 529 D. S. MAIN LOZ VLV 1.12.37 0. 90 DEG 2.5LO. MAA 1205 1 P 27-17544 .1. 544 V COMPUTER M16.5 PSUP 1:12.39 N20 0 VDC SLO 1.12.41 0 42 YDC SLO .I. SAB.Y ... COMPUTER 38 PSUP .H. 33,P., 81 HYD ACCUMPLATOR .1.12.43... 0.3500 PIA.160,SLO... 7.01731 9. 5129...1173.1...P. 27-11721 .1. 525.X...PRE-ARM SIGNAL 1 1 12 45 CFF ON SIP .1.12.47. OFF 1981. 524.X., PRE-ARM SIGNAL 2 1. 521 X VERN ENGINE COF SIG 11.12.49 QFF ON SIP .1. 522.X...S ENGINE COF SIG 1 12 49 OFF ON SIP... 1, STO, X ... STAGING SIGNAL 1, 12, 49 ... OFF ON ... STP... H. 140.P., SUSTYERN HYD PRESS (1:12.51). 9.3309., PIA. 45.5LQ., 7 91729 27-11650 F. 244 P ... B TANK HE BOTTLES HI. 1.12,53 ... 0.350 ... PIA, 105 SLO ... 7 01720 27-11482 5. 5452...1387.4...? SYNC & 1009 CALLS . 1.12.55... COMMACTED TO 1. 17 55.1.12.54..... CONNECTED TO 1 12 54, 1.12.57 CONNECTED TO 1 12 57.1.12.58,... CONNECTED TO 1 12 \$6,1,12,59.

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CONVAIR-ASTRONAUTICS

REPORT NO. AZC-27-059-12 SECTION 9 21 FEBRUARY 1961

MISSILE INSTRUMENTATION LOG SHEET

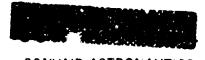
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MISSILE INSTRUMENTATION LOG SHEET
REPORT NO AZC-27-059-12 DATE 21 FEB 41

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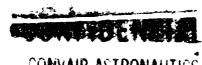
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SECTION 9

21 FEBRUARY 1961

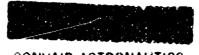
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CONVAIR ASTRONAUTICS

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CONVAIR ASTRONAUTICS

REPORT NO AZC-21-059-12 SECTION 9 21 PEBRUARY 1951

MISSILE INSTRUMENT ATION LOG SHEET
REPORT NO AZC-27-059-12 DATE 21 FEB 61 MISSILE 12E PAGE COMMUTATOR PIN NO ş STATION 3 DESCRIPTION NO. CAN NUMBERS 2 0 0 COMM. RATE CONT. 2 2 5680 6400 RPH 60 SLO 27 01267 1 52N 1198 4 P 27-11721 P. 84 B B1 PUMP SPEED I 29 V ROLL RESOLVER SIG 2 3 M10 10 VAC e 1 530 V PITCH RESOLVER SIG 2 4 M30 30 VAC 9:1. 528 V YAW STEERING SIG 2 6 M4.6 4.1 MIN 1 549 D PITCH SERVO ERROR 20 P 1 521 X VERN ENGINE COF SIG 2 6 S OFF ON 818 H2 e I 552 D REDNOT GYRO PICK-OFF 2 7 P 2.7 MIN 35 1 537 X COMPUTER REDUNDANCY 2 7 S OFF ON BLP 1 580 V AZM RESOLVER SIG M7.8 7.8 VAC P 2 8 40 I 581 W TIME T 2 8 BLP I 550 D ROLL SERVO ERROR M4.1 4.1 DEG 2 9 100 1 522 X S ENGINE COF SIG 2 9 5 OFF BLP M5.1 5.1 MIN I 551 D AZIMUTH SERVO ERROR 2 10 100 2 10 S OFF I 523 X SEV COF RELAYS BLP



REPORT NO 177 27 154 12

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S	25	7 D	SUSTAINER PITCH	2	11	3	M3 • Q	3.0	DEG	. 3	30	7 01680 3	1034	1210	2	M	27-11720
S	_ 20	5 D	BI YAW	2	11	5	M5	5	DEG	.5	30	7 01680 7	879	1212		м	27-11721
S	_20	3 D	81 PITCH ROLL	2	11	7	M5		!!	!		7 01680 7	1327	1212	1	M	27-11721
e 5	5	4 R	YAW RATE GYRO SIG	2	11	9	246	! ,	D/\$				34			М	
• 5		3 R	PITCH RATE GYRO SIG	2	11	11	M6	6	0/5	.3	15	H H	34			M	
• 5	5	2 R	ROLL RATE GYRO	2	11	13	MB	8	D/S	.3	15		34			M	
1	_52	9 v	ROLL RESOLVER SIG	2	11	15	M10		VAC		6					M	
• 1	53	0 V	FITCH RESOLVER SIG	2	11	17	M30	30	VAC		10					M	
• 1	52	8 V	YAW STEERING SIG	2	11	19	M3	3	VAC		10					M	
1	34	9 D	PITCH SERVO ERROR	2	11	21	M4.1	4.1	MIN		20					M	
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1	58	9 V	AZM RESOLVER SIG	2	11	31	M7.8	7.8	VAC		40					M	
î	55	0 D	ROLL SERVO ERROR	2	11	33	M4.1	4.1	MIN		100					M	
1	55	1 9	AZIMUTH SERVO ERROR	2	11	35	M5.1	5.1	MIN		100					M	
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н	21	9 P	S TK RESVR GAS	2	11	41	0	200	PIG	3%	SLO	27 01243 7	16092	1206	1	P	27-11651
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P	34) P	S LUBE OIL MANIFOLD	2	11	47	0	1000	PIA	38	SLO	7 01731 7	6121	1235	1	P	27-11720
A		5 P	V2 CLAMSHELL INNER	2	11	49	0	15	PIA	5%	SLO	55 01107 41				P	
@ H	5	2 P	S HYD ACCUMULATOR	2	11	51	0	3500	PIA	5%	SLO	7 01720 5	T			p	
e hi	37	9 P	SUS ROD LINE HI PR	2	11	53	0	3500	PIA	5%	SLO	7 01720 5	;		1	p	
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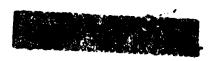
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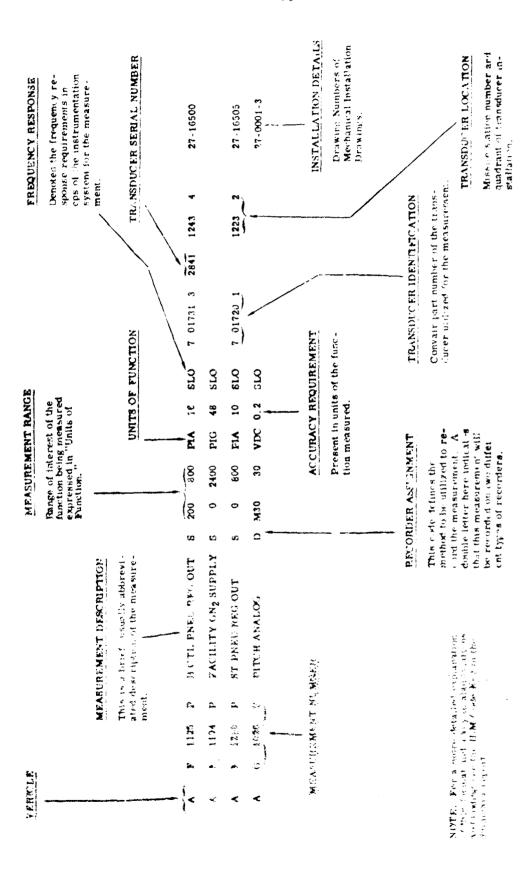
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SECTION 10

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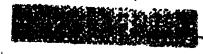
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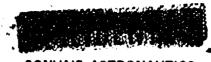
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18, U.S.C.; SECTIONS 793 AND 794, THE TEMPORACION REPURLIES WINDOWS TO ANY MICHIEF



MISSILE INSTRUMENTATION LOG SHEET REPORT NO. AEC-27-059-12 MISSILE IZE L/L 3 PAGE DESCRIPTION 188 E 5110 W INVERTER TIMER F 1309 D LOZ ULLAGE VENT VLV R F 1001 P LOZ TANK HELIUM 27-11679 F 5001 P LOZ TANK HELIUM 30 PIG 27 01243 5 16099 0 75 PIG 1 SLO 7 01723 13 V3217 F 1003 P FUEL TANK HELIUM 0 27-11663 F 5003 P FUEL TANK HELIUM 0 75 PIG 27 01243 27-11683 F 5032 P LM2 PRESSURE 0 4000 PIG F 5053 P NORM SUP PRESSURE M 0 4000 PIG 0 4000 PIG F 5054 P EMERG SUP PRESSURE F 5116 P DIFFERENTIAL PRESS 5 PID F 1145 P S CTL HE BTL DISCH G 3500 PIG 105 SLO 7 01720 5657 1213 5 27-11650 F 5145 P S CTL HE BTL DISCH M 0 3500 PIG 105 SLO 7 01720 5656 1213 27-11656 F 1194 F FACILITY GNZ SUPPLY 0 2400 PIC 48 SLC 5 T 1246 P B TANK HE BOTTLES HI 0 3500 PIG 65 SLO 7 01720 5452 27-11682 F 5246 P B TANK HE BOTTLES HI 0 4000 PIG Ħ 7 01720 27-11682 F 1301 P GND LOZ ULLAGE TANK 20 30 PIG -1 SLO \$ F 1302 P GND FUEL ULLAGE TANK P S 55 65 PIG .1 SLO F 5247 T BSTR TANK TEMP M80 M380 DGF 7 01433 5B 60107 1221 4 P HYDRAULIC SYSTEM 0 200 PIA 58 SLO 27 01243 11 # H 1360 P | HPU SUSTAINER RETURN H 1187 X BSTR OIL EVACUATION R OFF 11188 X SUST OIL EVACUATION VDC # 1 1515 A ACCELEROMETER X F1

> THIS MATERIAL CONTAINS IMPRIMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPHONAME LAMS, TITLE 18, U.S.C., SECTIONS 783 AND 784, THE MEANINGSIDIL OF SEVELATION OF WHICH IS ANY MANNEY TO AN UNAUTHORIZED PERSON IS PROMISITED BY LAW



CONVAIR-ASTRONAUTICS

MISSILE INSTRUMENTATION LOG SHEET MISSILE_ 12E L/L DATE 21 FEB 61 PAGE RECORDER TRACK CHANNEL DESCRIPTION 8 100 ACCELEROMEYER Y FI 0 1 1537 A ACCELEROMETER Z F1 12 MIZ # 1 1518 A ACCELEROMETER X F2 M12 O 1 1519 A ACCELEROMETER Y F2 12 M12 # I 1520 A ACCELERCHETER Z F2 M12 12 I 1591 C. PITCH GYRO TORQUE 75 MA 1 1592 C ROLL SYRO TORQUE M75 75 MA I 1593 C YAW GYRO TORQUE 75 MA 8 1 1594 D PENDULUM #1 NULL M30 30 e I 1595 C PENDULUM #2 MULL 5 M30 30 MA # I 1594 D OPTIC SIGNAL M30 30 MA 6K @ 1 1505 H COMPUTER POSITION X 10K ● 1 1506 H COMPUTER POSITION Y M300 500 MM 10K J I 1507 H COMPUTER POSITION Z 700 NM # I 1508 H RANGE ERROR FUNCTION P # I 1509 H AZM ERROR FUNCTION M300 500 LOK 0 22K . I 1502 L COMPUTER VELOCITY X F/S 10K # I 1503 L COMPUTER VELOCITY Y 4K F/S 10K # 1 1504 L COMPUTER VELOCITY Z O I 1601 V 400 CPS REFERENCE 10 VDC 155 I 1606 V COMPUTER RESET 0 # 1 1510 W ELAPSED TIME I 1521 X VERN ENGINE COF SIG I 1522 X S ENGINE COF SIG P I 1570 X STAGING SIG



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> THIS MATERIAL CONTAINS INFORMATION AFTECTING THE MATHEMAL DEFEND OF THE UNITED STATES WITHOUT THE MELANDE, OF THE ESPANDANC LAWS TITLE 18, U.S.C. DECEMBER THE AND THE THE ENABREMENTS ON REPELATION OF MEMORY IN ARTHUMOUS TO BE MEMORY THEORY IN PRODUCT OF LAW





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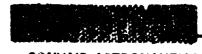




MISSILE INSTRUMENTATION LOG SHEET
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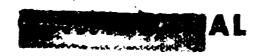


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MISSILE INSTRUMENTATION LOG SHEET
REPORT NO AZC-27-059-12
DATE 21 FEB 61 DESCRIPTION



REPORT NO AZC-27-059-13

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CONVAIR (ASTRONAUTICS: DIVISION GENERAL DYNAMICS CORPORATION

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CO-ORDINATED BY W.S. P. L. Ce.

W. S. Becker

APPROVED B

H. R. Maedonald

Test Planning

CHECKED BY T. M. Unite

T. M. Wooster Instrumentation APPROVED BY ..

P. J. Lynch

Chief - Field Test

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CONVAIR-**ASTRONAUTICS**

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THIS MATERIAL CONTAINS FORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS, TITLE 18, U.S.C., SECTIONS 793 AND 754, THE TRANSMISSION OF REVELATION OF WHICH IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW.



REPORT NO. AZC-27-059-13

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27 FEBRUARY 1961

FOREWORD

This report has been published in accordance with contractual requirements as cited in Convair-Astronautics Report ZM-7-289. It describes the instrumentation released for Missile 13-E as of 27 February 1961.

Information presented here will he used by Air Force, Associate Contractors, Design, Operation, and Field Test Groups. Measurement modification will either originate in the Instrumentation Section of the Test Planning Group or will be submitted as a recommendation to this group.

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SUMMARY

The instrumentation configuration for this missile has been established through a study of program test objectives, systems analysis, and operating considerations. A discussion of missile instrumentation and associated characteristics has been summarized in Report AZC-27-059. For a detailed description of the various missile systems, test objectives, and general test program see Report AE60-0436.

To clarify specific measurements, instrumentation location schematics have been included in Report AZC-27-059, Section 7.

A list of special instrumentation for 13E has been included on page 4 - of this revision.

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REASONS FOR REVISION "A" CHANGES

INTRODUCTION

I.

Due to the inflight failures of missiles 3E, 4E, and 8E, additional instrumentation has also been added to missile 13E to continue the evaluation of the airborne hydraulic system, the effects of radiant heating, and aerodynamic heating of V-2 electrical components.

The bracket which mounts the sustainer engine control package to the engine

has been strongthened by Rocketdyne to preclude any inflight failures. Ereak wires attached to the sustainer engine control package (H387X, H388X) and mein hydraulic distribution manifold (H389X) will indicate mounting bracket failures. A reasurement recommended by Rocketdyne for analysis of the sustainer engine control package performance has also been added, Accumulator gas pressure (H398P).

Measurements of flow to the sustainer engine control (H384R), to the high pressure distribution manifold (H386R), to the hydraulic reservoir via the high pressure relief valve (H383R), and from the vernier distribution manifold (H385R) will provide data on overall system performance as well as isolate the location of a failure in the high pressure portion of the system. A low pressure measurement in the vernier return line (H212P) in conjunction with the Hydraulic Pumping Unit bustainer beturn (H1360P) pressure will provide additional data for a pressure survey in this area of the system. Data for malfunction analysis of the high pressure system will also be provided by pump discharge (H130P), and line (H191P) pressure measurements. (See Figure 1).

A check valve has been installed in the sustainer high pressure line upstream of

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the staging disconnect. This will prevent loss of hydraulic fluid in the event that the disconnect couplings become damaged. A heat shield has been added over the rise-off disconnect panel and sliding poppets have been added to the disconnects themselves to protect them from radiant heating. In order to obtain information on the amount of heating of the rise-off disconnect panel, thermocouples have been installed at the booster (H317T) and sustainer (H316T) high pressure rise-off disconnects.

In addition to the foregoing, Sustainer Hydraulic Pump Inlet Pressure (H185P) will be installed. This measurement was planned previously as part of the overall instrumentation package for missile 13E. (See Figure 1).

Sequence measurements in the Hydraulic Pumping Unit will provide data on booster (H1187X) and Sustainer (H1188X) system hydraulic fluid evacuation. (See Figure 1). The extensiometers are located on the upper pedestal supports on the launcher.

II. In a "tion to the thermocouples, three (3) calcrimeters have been placed on the aft heat shield on 13E. See Figure 2 for approximate locations:

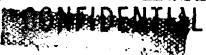
A 409T Black Celor Q1

A 439T 38 GM Calor Q1

A 443T 19 GM Calor QIV

The CV-A calorimeters are clustered in groups of three to give the heat transfer coefficient along with readings of convection and radiation quantities. The 19 gram gold calorimeter provides a measure of convection heat while the black calorimeter will provide total heating information. The third calorimeter in the group, 38 grams, combined with the other two calorimeters will give the heat transfer coefficient. All calorimeters are mounted facing aft and approximately 3 inches in diameter for each calorimeter.

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Due to the danger of soot or other elements plating the surface of the relatively large calorimeter clusters during launch period and producing incorrect data, two nine (9) inch pie tins will be placed over the clusters as covers. The pie tins will be mechanically removed after the first ten (10) feet of flight. Camera coverage will substantiate the successful removal of the two pie tine.

III. High temperatures in the conduit, electrical connectors, and the fairings around the vernier engines have been considered as a possible cause for short circuiting. To accurately determine the inflight temperature environment at these locations the following measurements will be made on 12E.

- A 1 T V2 FAIRING AMBIENT (Inside),
- A 2 T V2 CLAMSHELL AMBIENT (Inside),
- A 3 T V2 COMDUIT (Near Center), and
- A 4 T V SERVO ELECTRICAL CONNECTOR (Surface).

Thermal input will be a combination of aerodynamics, engine plume, and electrical component heating. The clamshell fairing, mounted on the side of the vernier engine, has several large openings which facilitate gimbaling.

Temperatures of thermocouple reference junctions (T2T, T3T, T103T, T162T) will be made to insure accurate data from all thermocouples. These reference junctions are used with measurements made on the booster, sustainer, and vernier engine areas respectively.

IV. Redesign of the cooling distribution systems for ARMA B1 and B2 pods requires data provided by the following additional instrumentation: 12 temperature measurements on the ROTARY INVERTER in the 22 POD, QUADRANT 2; 16 temperature measurements on the GE PULSE BEACON in the B1 POD, QUADRANT 4; 8 temperature measurements on the NO. 2 TELEMETRY FACKAGE, B1 POD, QUADRANT 1. At the launcher, 10 pressure measurements have been added for PITOT TURES, and 5 temperature measurements for PORTABLE

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THERMOMETERS. There are 2 additional pressure measurements (L1452P and L1453P) for the PORTABLE MANOMETERS.

V. To provide higher quality data during the critical portions of launch, and supply booster engine rough combustion data for the first 15 feet of missile travel, 2 accelerometer measurements will be monitored via trailing wire umbilical.

	DISCRIPTION						
P14390	NAA RC ACCEL						
P14520	B1 NAA RCC ACCEL						
P14530	B2 NAA KCC ACCEL						

/I. The booster LOX pust inlet temperature measurements have been added as operational redlines.

ADD

P 1020 T BI LOX PUMP INLET

P 1054 T B2 LOX PUMP INLET

VII. This measurement will indicate the number of guidance computer off-on cycles and help to establish the computer run time when combined with measurement 1 1510 W.

I 1606 V COMPUTER RESET

VIII-The following sequence measurements will be used for flight test and systems validation by providing time-sequence of operation of these functions during ground checkout.

ADD

P 1225 I ENGINE COMPROL READY

P 1229 X LO2 HIGH TUPPING

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MEAS. NO. DESCRIPTION CHANNEL

P 1230 X LO2 LOW TOPPING

P 1231 X 100% SLUG COM

IX The following measurements were added to provide a record for proof of proper sequence operation or data for failure analysis. These measurements will be made during the Integrated Systems Test of the A/P programmer.

<u>ADD</u>

S 1370 X STAGING

S 1371 X BOOSTER JETTISON

S 1372 X PRESSURIZE

S 1373 X BOOSTER CUTOFF

S 1374 X SUSTAINER CUTOFF

S 1375 X VSHPS BACK-UP SIGNAL

S 1376 X VERNIER CUTOFF

S 1377 X EJECT RV UMBILICAL

S 1378 X RV JETTISON

S 1379 X FIFT RETRO POCKETS

X. The following measurements will be used to determine the cause of Impact Predictor drop out experienced on the G.E-I.P. system on "D" AiG flights.

AU:

0 281 Y	RB REFLECT SET	1.11.49
G 302 C	PB-IP MODULATOR AVG	1.11.53
G 588 P	WAVEOUIDE PRESS 1	1,12.7

.

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MEAS. NO.	DESCRIPTION	CHANNEL
G 589 P	WAVEGUIDE PREES 2	1.12.9
G 197 0	RB-IP RADIAL	1.C.1 thru 15
G 940	BOOM AIRTENNA	1.0.17 thru 31
G 587 0	POD WAVEGUIDE	1.C.33 thru 47

II. A backup booster staging acceleration switch, located in the pod, will be flown open-loop on this missile. This is being done to gather date to evaluate this system since it will operate closed-loop for Agens B, Midas/S: non and Cantaux missiles. The switch will supply a backup staging signal, insuring staging in the event that the normal staging discrete from guidance is not supplied to the programmer.

The acceleration switch is essentially a spring-mass system, having fluid damping and utilizing a differential transformer for signal pick-off. This signal is filtered and supplied to an electronic switching circuit which closes a relay at a preset acceleration level. The accelerameter signal voltage (\$3850) and switch activation (\$3591) are monitored for evaluation purposes.

XII. Four measurements have been added to determine that proper sequencing of the LOX slug transfer valves occurs.

<u>12.45</u> .	
ADD.	
E 1356 X	SIG CHE LOZ LOW JEVEL
¥ 1932 X	THE LEMO AND CRORED
H 1933 X	TOS TEMS VEV OFFI
第三 9 X	THE TAY CLAST

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XII Operating measurement F1194P has been added to ascertain the accuracy of the GN2 supply pressure during countdown and hold.

XIII These measurements, applicable only on FRF missiles, have been deleted on 13E.

MEAS.	DESCRIPTION
DELETE	
P 1010 P	B 1 LUBE OIL INJ HIN
P 1011 P	B 2 LUBE OIL INJ MAN
P 1232 P	S LO2 SEAL CAV TY
P 1465 P	S LO PR LUBF OIL MAI!
P 1227 X	LOX DOME PURCE
F 1228 X	IGNITER FUEL PURGE
P 1785 X	B SECUMPARY SHUTDOWN
P 1226 X	PNEUMATICS CUTOFF

There is no sustainer I and pressurization bottle on F series missiles, therefore the following measurement, FM and P, S TANK Hr. BOTTLE HI, has been deleted.

NV Due to complexity in making and calibrating measurement 12E, KLYSTHOM PW OUTPUT, it has been deleted.

XVI The Roll program is accomplished by ArDA signal, which function is monitored by measurement 1529V. Therefore S 1049 V is not required.

XVII Measurement H 315 I has been deleted because it is a duplication of the new measurement H 185 F.

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AVIII. There is no further test data need on LOX slug transfer units at AMR.

Therefore N 1314 T SLUK CHG 102 DISC is deleted.

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SPECIAL 13F INSTRUMENTATION LIST

MEAS. NO.	DESCRIPTION	RANGE	TRANSDUCER TYPE
A 3 T A 4 T A 409 T A 439-T A 443 T F 1194 P G 302 C	V2 CLAMSHELL AMB V2 CONDUIT V2 SERVO ELEC CON BLACK CALOR QI 38 GM CALOR QI 19 GM CALOR QI FACILITY GN2 SUPPLY PT -1P MODULATOR AVG BOOM ANTENNA	0-1000 DGF 0-1000 DGF 0-1000 DGF 0-2500 PTA	Fe/Cn TC Fe/Cn TU 27-11912-5 27-11912-3
G 588 P G 588 P G 281 V H 130 P H 185 P H 191 P H 212 P H 398 P H 383 R H 384 R H 385 R H 386 R H 316 T H 317 T H 1187 X H 1188 X H 387 X	POD WAVEGUIDE WAVEGUIDE PRESSURE 1 WAVEGUIDE PRESSURE 2 RB REFLECT DET S HYD PUMP DISCH S HYD PUMP INLET S HIGH PP TO MAN VERNIER RETURN HPU SUSTAINER RETURN NAA HYD ACCUM GAS SUS FLOW TO RES SUS FLOW TO NAA CONT SUS FLOW FROM V MAN SUS FLOW FROM V MAN ROD PANEL SUS IN ROD PANEL BOOSTER IN BSTF OIL EVACUATION SUS OIL EVACUATION S ENG CNTL BRACKET	OFF-ON VDC OFF-ON VDC ON-OFF VDC	7-91720-5 27-01234-11 7-01720-5 27-01243-11 27-012/3-11 7-017<0-5 27-01281-1 27-01281-1 27-01281-1 07/01 TC 0r/01 TC
н 389 х	ENG CNTL TO PR LINE HYD MANIFOLD TO CONE COMPUTER RESET SIG CH LOX LOW LEVEL LOX TPNG VLV CLOSED LOX TPNG VLV OPEN PRESS VLV CLOSED S NAA RCC ACCEL B 1 NAA RCC ACCEL B 2 NAA RCC ACCEL B 1 LOX PUMP INLET B 2 LOX PUMP INLET	ON-OFF VDC	

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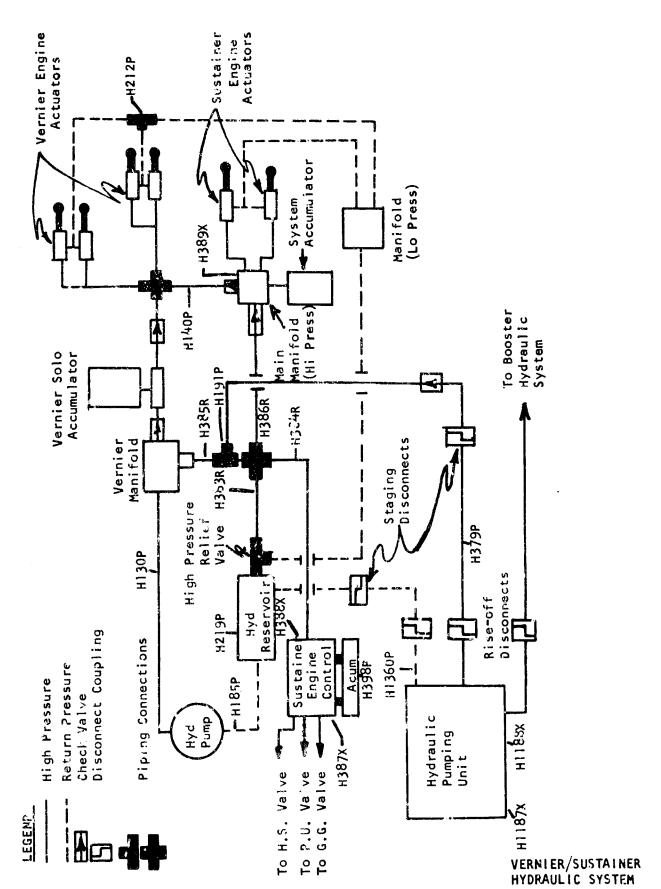
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MELS. NO.	DESCRIPTION	RANGE	TRANSDUCER TYPE
P 1225 X	ENGINE CONTROL RELAY	OFF-ON VDC	
P 1229 X	LOX HIGH TOPPING	OFF-ON VDC	
P 1230 X	LOX LOW TOPPING	OFF-ON VDC	
P 1231 X	FNEUMATICS CUTOFF	OFF-ON VDC	
პ 385 V	ACCEL 400 CYCLE COM	O-11 VAC	
S 359 X	BOUSTER STACING B/U	OFF-ON VCC	
3 1370 X	STAGING	OFF-ON VDC	
S 1377 X	BOOSTER JETTISON	OFF-ON VDC	
S 1372 X	PRESSURIZE VERN TANK	OFF-ON VDC	
S 1373 X	BOOSTER CUTOFF	OFF-ON VDC	
S 1374 X	SUSTAINER CUTOFF	OFF-ON VDC	
S 1375 X	VSHPS BACK-UP SIGNAL	OFF-ON VDC	
s 1376 %	VERNIER CUTOFF	OFF-ON VDC	
S 1377 X	EJECT RV UMBILICAL	OFF-ON VDC	
S 1378 X	RV JETTISON	OFF-ON VDC	
S 1379 X	FIRE RETROROCKETS	OFF-ON VDC	
T 2 T	Bl T/C REFER JUNCT	0-200 DGF	27-01287-1
T 3 T		0-200 DGF	27-01287-1
T 103 T	BOOSTER T/C REF	0-200 DGF	27-01287-1
T 162 T	v t/g refer junct	0-200 DGF	27-01287-1

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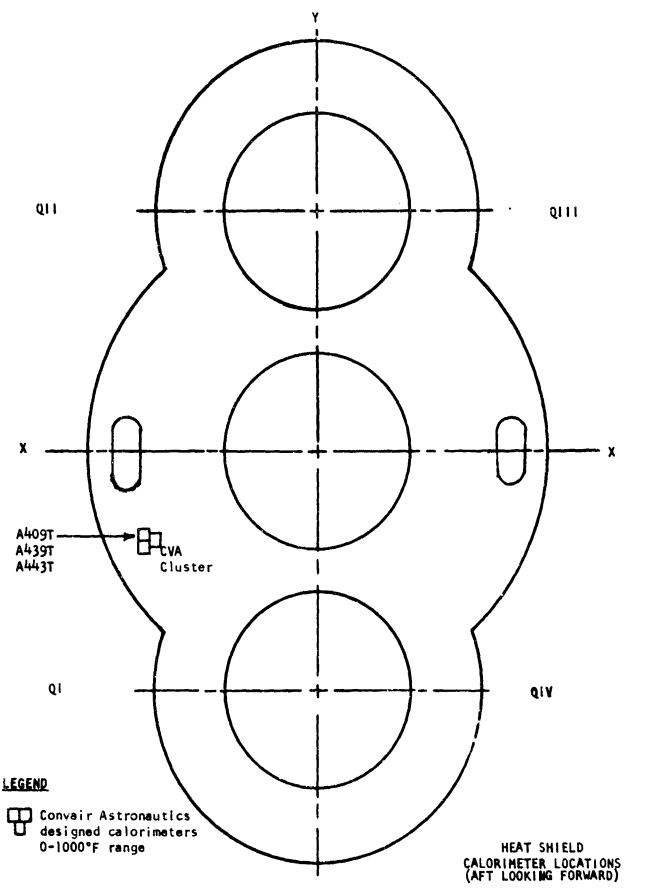


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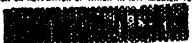


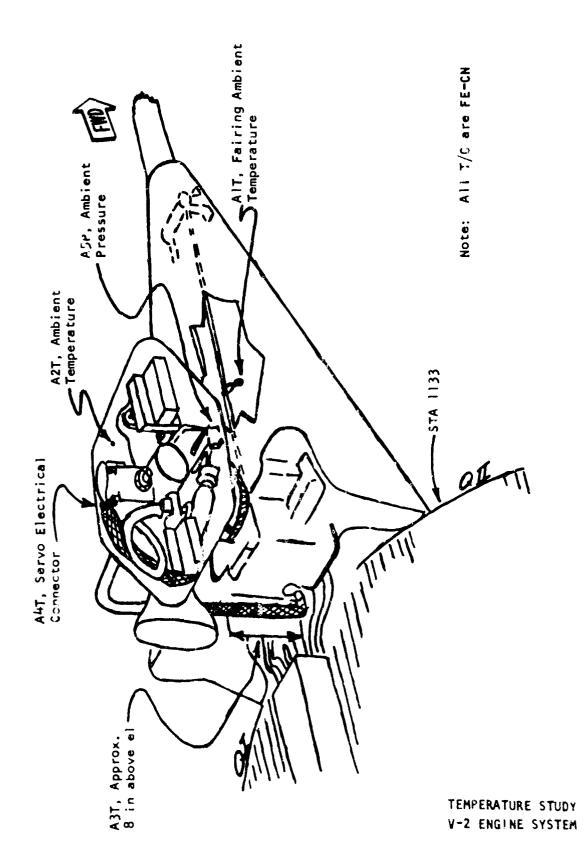
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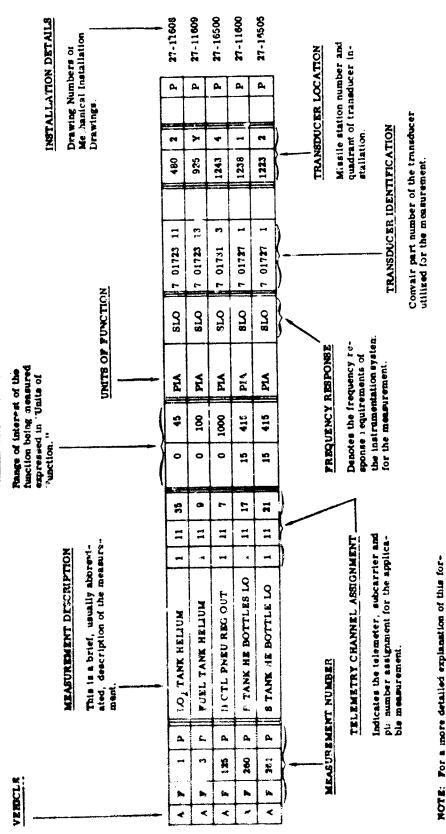
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ACT ON

ACRECLE INSTRUMENTATION BY SYSTEM

The Missile Instrumentation Log presented in this section contains the latest available characteristics of the individual measurements. In addition, the telemetering channel assignments are included. Note that this section is listed by system.

MEASUREMENT RANGE



MOTE: For a more detailed explanation of this format and a key to abbreviations and coding see the IBM Code Key in the Summary report.

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SECTION 8

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A	AIRFRAME			• • •		00 H4400 0	*** 41 		-		
A 638	T AFT SIDE A FRAME Q2	1 11 13	M100 300	DGF	SLO	27 01287	3			•	27-11793
D	RANGE SAFETY SYSTEM			·			:		+ - -		
D 1 V	A DEC CHICAGE ONITRHIT	1 11 7	0 31	vn-	STP		+	-			
	RSC CUTOFF OUTPUT				BLP						
<u> </u>	#I RSC RF INPUT/AGC	1 A 5	100٪ د1	UV	SLO	•				ρ	
D 3.)	RSC DESTRUCT OUTPUT	2 E 95	0 30	voc_	STP						
<u> </u>	ELECTRICAL POWER SY	S		•	•			<u>.</u>			
E 50 0	400 CYCLE AC PHRSUP	1 1	370 430	CPS	SLO					•	
E 28 V	MSL SYSTEMS INPUT	1 13 11	0 30	VOC	SLO	•		•	- 1	•	
	400 CYCLE AC PHASE				SLO	• 		-	*		
. E. 53 V	1 100 CYCLE AC PHASE	1 13 23	105 125	VAC	sto			•	•••		
F	PNEUMATIC SYSTEM								•		
								•			
F 1_P	LOZ TANK HELTUM	1 15 33	0 45	PIA	SLO	7 01723	11	484	3	-	27-11670
	FUEL TANK HELTUN							944			27-11683
	SICTL HE BIL DISCH									7	27-11650
	E TANK HE BOTTLES H	1. 4. kf. 77	0,3300	15.	500	Q1/20	7	1147			27-11482
	LOZ PRESS REG INLET	1 11 5	₩200 Z00	DGF	SLO	7 01694	3	1205	4	F	27-11682
f . 247, t	B TANK HE BUTTLES	1, 11, 35	MA 00 M 250	067	SLO	7 01633	,	1221	4	-	27-11682
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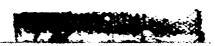
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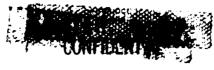
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				-	
G 582 E NOO 111 RB RF	Outfout 1 11 1	0 15 E			
			360	*	
			· · · · · · · · · · · · · · · · · · ·	*	
G 503 V MOO III PB AGC		0 M4.8 VDC	SLO		
G 579 V MOD III RB AGC	NO. 1 1 11 21	•	SLO		
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H 33 P B1 HYD ACCUMUL	4TOR 1 12 43	0 3500 PIA	SLO 7 01731 S	1173 1 0	27-11721
HE 140 P SUS/VERN HYD P	RESS 1 12 51	0 3500 PIA	SLO 7 01720 5	1213 2 P	27-11650
H 219 P S TR RESVR GAS	2 11 41	0 200 PIG	5LO 27 01243	7 P	
H 224 P B HYD SYS LO P		^ 200 PIG	SLO 27 01243 11		
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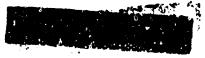
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SECTION 8



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SECTION 8

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P 28 P V	1 THRUST CHAMBER	1 A 33	0, 400 PIA	St 0 7 01737	3 1127 A P	27-116 99
P 29 P V	72 THRUST CHAMBER	1 A 25	0 400 PIA	SLO 7 01737	3 1127 2 P	27-11699
P 30 P V	ERNIER LOZ TANK	1 13 13	0 1000 PIA	510 7 01720	3 1208 Y P	27-11651
P 38 P 8	2 FUEL PUMP DISCH	2	0 1000 PIA	15 7 01731	5 1144 7 P	27-11772
9 39 P. 8	I FUEL PUMP DISCH	2 E 21	0 1000 P91	15. 7 01731	5. 1173 1 P	27-11721
P 56 P S	LOZ PUMP INLET	1 13 17	0 150 PIA	SLO 27 01243	9 1295 X P	27-11720
P 59 P 5	2 THRUST CHAMBER	2 E 11	7 600 PIA	15 7 01751	1 1244 Y P	27-11684
P 60 P 8	11 THRUST CHAMBER	2 E 0	0 300 PIA	15 7 (17%)	1 1244 Y P	27-116**
P 91 P 8	11 LO2 INJ MANIFOLD	1 13 19	0 1500 PIA	SLO 7 01731	5 12•4 × P	27-11684
P 92 P R	7 LOT INJ MANIFOLD	1 13 15	0 1000 PIA	SLO 7 01731	9 1744 Y B	27-11684
P 195 P B	1 GAS GEN COMBUSTON	1 12	1000 PIA	SLO 7 01731	5 pl	27-11727
P 184 P 8	Z GAS . 4 COMBUSTON	1 12 33	0 1000 PIA	5L0 7 01731	5 P	27-11730
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P 337 5 5	GG LOZ ING MAN	1, A, 31,	0 1000 PIA	5LO 7 01731	5 1235 X P	27-11770
P 341 P 5	LUBE OIL MANIFOLD	2, 11, 47,	0 1000 PIA	SLO: 7 01731	7	
P 351 P 5	LOS INJ MANIFOLD	1, 13, 49,	0, 1000PIA	SLO 7 01731	5 1235 X P	27-11771
P 473 P E	ILO PRILUBICIE MAN	2 11 45	0 100 216	SLO 27 01243	9 9	
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22 JUNE 1960

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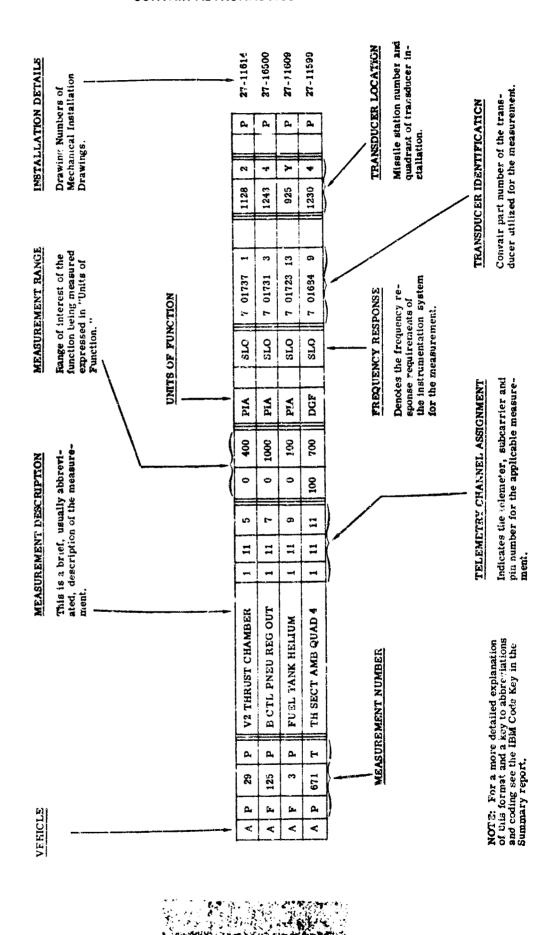
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MISSILE INSTRUMENTATION BY CRAINEL

The Missile Instrumentation Log presented in this section contains the latest available characteristics of the individual measurements. In addition, the telemetering channel assignments are included. Note that this section is listed by channel.





SECTION 9

22 JUNE 1960

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SYSTEM	MLASURFAENT NUMBER	TYPE MEASUREMENT	DESCRIPTION	TELEMETER MO.	SUB-CARRIER NO.	CCMMUTATOR PIN NO		(AA)		UNITS OF FUNCTION	ACCURACY	RATE OF CHANGE OR FREQUENCY OF FUNCTION		OF TRANSDUCE	ı	SERIAL NO.	STATIO NO.	× Visuality	- ANY MAN	CARD COOR	DEAWII
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р	349	В	S PUMP SPEED	1	3			9.9	11.2	KPN		SLO	27	01264	3		123	4	3	P	27-11720
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SECTION 9

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CONVAIR-ASTRONAUTICS

REPORT NO AZC-27-059-13 PATE TO DATE

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FORM A1330-8

SECTION 9

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AZC-27-059-15 INSTRUMENTATION LOG SHEET 60

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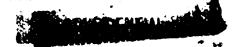
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AZC-27-095515 INSTRUMENTATION LOGS SHEET 60

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CONVAIR-ASTRONAUTICS

REPORT NO. AZC-27-059-13

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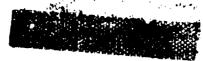
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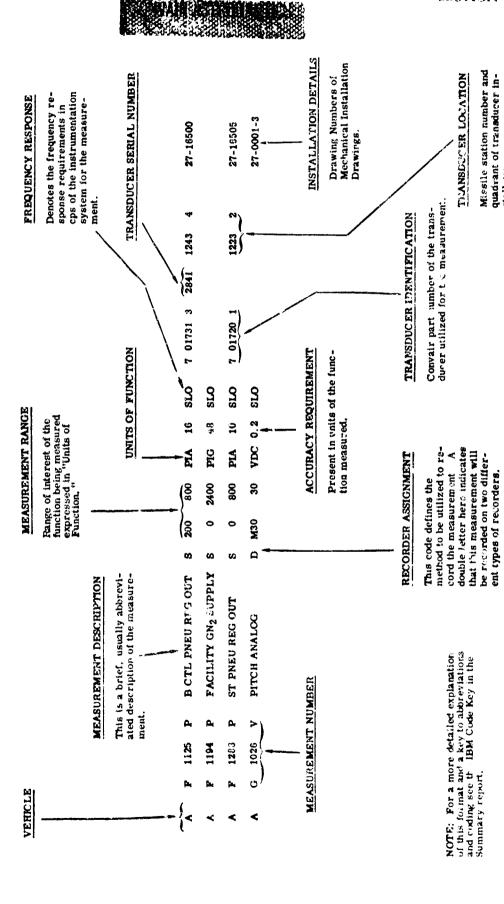
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SECTION 10

LANDLIN E INSTRUMENTATION

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SECTION 10

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CONVAIR ASTRONAUTICS

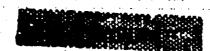
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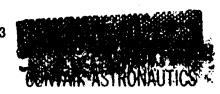
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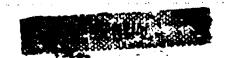




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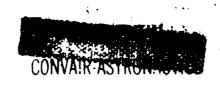
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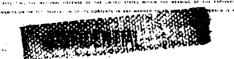
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REPORT NO. AZC-27-059-16

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CONVAIR (ASTRONAUTICS) DIVISION GENERAL DYNAMICS CORPORATION

WS-107A-1

INSTRUMENTATION CONFIGURATION

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CO-ORDINATED BY

W. S. Becker

APPROVED D

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H. R. Macdonald

Test Planning

CHECKED BY

LAT. M. Wooster

Instrumentation

APPROVED BY

P. Lynch

Chief- Field Test

Engineering



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FOREWORD

This report has been published in accordance with contractual requirements as cited in Convair-Astronautics Report ZM-7-289. It describes the instrumentation released for Missile 16E as of 8 March 1961.

Information presented here will be used by Air Force, Associate Contractors, Design, Operation, and Field Test Groups. Measurement modification will either originate in the Instrumentation section of the Test Planning Group or will be submitted as a recommendation to this group.



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SUMMARY

The instrumentation configuration for this missile has been established through a study of program test objectives, systems analysis, and operating considerations. A discussion of missile instrumentation and associated characteristics has been summarized in Report AZC-27-059. For a detailed description of the various missile systems, test objectives, and general test program, see Report AE60-0437.

The specific measurements to be transmitted via telemeter have been tabulated and are listed in Sections 8 and 9 in terms of instrumentation system and telemeter channel assignments.

In addition to the telemetry, the landline instrumentation programs for this missile has been included in this report in the form of a master tabulation of landline measurement characteristics, (Section 18).

To clarify specific measurements, instrumentation location schematics have been included in Report AZC-27-059, Section 7.

There are a total of 191 telemetered measurements on 46 channels in this missile divided as follows:

	ACCIL	DEFL	F06	FRES	THEMP	TOL	DIS. POS	MISC	TOTAL
A/FRAME					34				34
PNEU				8	18				26
GUID						2		2	41
HYD				2					2
INER, GUID	6	1	5	7	5	11	8	5	45
PROP		2		20	5		3	3	33
A/P SYS		13					1	3	17
MISC	1	1		2	2	7	14	3	30 191
TOTAL	7	20	5	33	64	20	26	16	191

There are also 168 measurements recorded and displayed via 168 landline channels.

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REASONS FOR REVISION "A" CHANGES

I Data obtained from the following temperature measurements will reveal total heating rates, relative heating intensity of a hot spot between the engines, the relative heating intensities of the outer and inner heat shield peripheries, and model scaling laws applicable to recirculation predictions.

MEAS NO.	DESCRIPTION	CHANNEL
A933T	AEDC AFT SHIELD CALOR	3-10-41
A934T	AEDC AFT SHIELD CALOR	3-10-43
A935T	AEDC AFT SHIELD CALOR	3-10-45

II To provide higher quelity data during the critical portions of launch, and supply booster engine rough combustion data for the first 15 feet of missile travel, three (3) accelerometer measurements will be monitored via trailing wire umbilical.

MEAS NO	DESCRIPTION
P14390	S NAA RCC ACCEL
P14520	BL NAA RCC ACCEL
P14530	B2 NAA RCC ACCEL

III Computer Reset I1606 V, demonstrates the start of computer cycling; it is a convenient initial operating time reference to be used with measurement I1510 W, ELARSED TIME.

The booster engine LOX pump inlet temperatures (Pl020T, Pl054T) will be monitored by regular landline instrumentation system during launch countdown. This information will assure that turbopump starting NFSH requirements are satisfied and determine the adequacy of the LOX topping and slug systems.

V It is important to know the weight of LOX boileff during flight for accurate evaluation of the overall effect on missile performance resulting from the removal of intermediate bulkhead insulation. Sixteen (16) temperature measurements have been added to provide this data.

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VI Four measurements have been added to determine that proper sequencing of the LuX slug transfer valves occurs.

ADD	DESCRIPTION
N1356X	SLG CHG LO2 LOW LEVEL
N1932X	LO2 TPNG VLV CLOSED
N1933X	LOZ TPNG VLV CLOSED
N1979X	Præss vlv closed

VII These measurements, applicable only of FRF missiles, have been deleted on 16E.

MEAS. DELETE	DESCRIPTION
Plolop	Bl LUBE OIL INJ MAN
PlollP	B2 LUBE OIL INJ MAN
P1232P	S LO ₂ SEAL CAVITY
P1465P	S LO PR LUBE OIL MAN
P1227X	LOX DOME PURGE
P1228X	IGNITER FUEL PURGE
P1785X	B SECONDARY SHUTDOWN
P1226X	PNEUMATICS CUTOFF

VIII Due to the complexity in making and collibrating measurement Z2E, KLYSTROM PW OUTPUT, it has been deleted.

IX The roll program is accomplished by ARMA signal, thich function is subttored by measurement 1529V. Therefore measurement STOASX, TROCKANGER HOLL SIGNAL HAS BEEN DELETED.

X Escause there is no further test data needed on LOX slug transfer units at AMR, measurement N1314T, SLUC CHS LO2 DISC has been deleted.

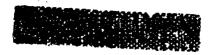




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SECTION 8

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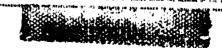
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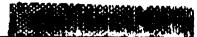
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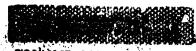
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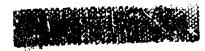
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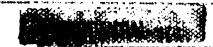
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REPORT NO. AZC-27-089-16 CONVAIR-ASTRONAUTICS

SECTION S S WARCH 1961

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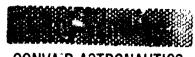
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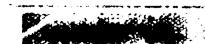
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REPORT NO. AZC-27-059-16 SECTION 8 8 MARCH 1961

MISSILE INSTRUMENTATION LOG SHEET MISSILE_ TIPE MEASUREMENT NATE OF CHANGE OR FREQUENCY OF FUNCTION TYPE ---\$500 SE 70 DESCRIPTION OF ŏ TRANSDUCER LOW



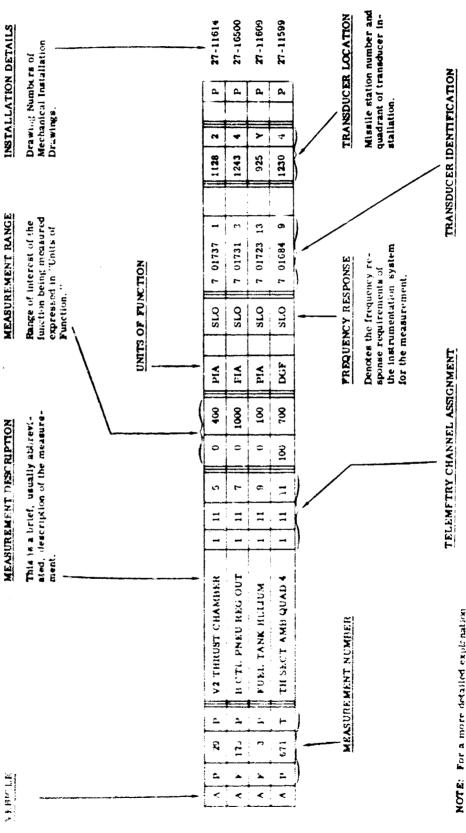


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The Meralle instrumentation Log presented in this rection contains the latest available characteristics of the individual measurements. In addition, the telementation of the individual measurements in addition, the telemetering channel.

MISSILE INSTRUMENTATION BY CHANNEL

SECTION 9



NOTE: For a more detailed explanation of this format and a key to abbreviations and exting see the IBM Code Key in he Summary report,

Indicates the telemeter, subcarrier and pin number for the applicable measurement.

Convair part number of the transducer utilized for the measurement.



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SECTION 9

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	MISSILE	INSTRUMENTATION	LOG	SHEFT	
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SECTION 9 8 MARCH 1981

MISSILE 168

CONVAIR-ASTRONAUTICS

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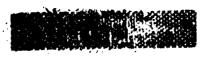
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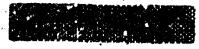
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REPORT NO. AZC-27-059-16 SECTION 0 8 MARCH 1961

MISSILE INSTRUMENTATION LOG SHEET
AZC-27-059-16
DATE 08 MAR 62 134 PAGE TELEMETER NO SUB-CARRIER NO COMMUTATOR PIN NO PATE OF CHANGE OF PEGUENCY OF PUNCTION SYSTEM SYSTEM MEASUREMENT NUMBER UNITS FUNCTION DESCRIPTION GERTAL NO. 27-11721



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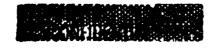
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P. Jia T. BJ GAS GER COMBUSTOR 3.11. 7. 0.1900 DGF . SLO. 27 01247 1. 881 1210.3 P 27-11722 P. 709 T. SGG COMBUSTOR 3.11. 9. 0.1500 DGF . SLO. 27 01247 3. 1041 1224.8 27-11726 A. ABZ T. BL ALG POD IRSUL OUT. 3. 11. 11. 500. 1500 DGR . 40. SLO. CR/CR . 1012.2 P 27-11844 A. ABJ. T. BL ALG POD IRSUL OUT. 3. 11. 15. 500. 1500 DGR . 40. SLO. CR/CR . 1012.2 P 27-11844 A. ABJ. T. BL ALG POD IRSUL IN . 3. 11. 17. 500. 1500 DGR . 40. SLO. CR/CR . 1091.2 P 27-11844 A. ABJ. T. BL ALG POD IRSUL IN . 3. 11. 17. 500. 1500 DGR . 40. SLO. CR/CR . 1091.2 P 27-11844 A. ABJ. T. BL ALG POD IRSUL IN . 3. 11. 27. 500. 1500 DGR . 40. SLO. CR/CR . 1088.3 P 27-11844 A. ABJ. T. BL ALG POD IRSUL IN . 3. 11. 27. 500. 1500 DGR . 40. SLO. CR/CR . 1088.3 P 27-11844 A. ABJ. T. BL ALG POD IRSUL IN . 3. 11. 27. 500. 1500 DGR . 40. SLO. CR/CR . 1088.3 P 27-11844 B. F. 777 T. LOX TX ULG STA 540 3. 11. 23. 500. 1500 DGR . 40. SLO. CR/CR . 1088.3 P 27-11824 B. F. 777 T. LOX TX ULG STA 540 3. 11. 33. 150. 1500 DGR AS SLO. CR/CR . 570 Z P 27-11824 B. F. 777 T. LOX TX ULG STA 540 3. 11. 33. 150. 1050 DGR AS SLO. CR/CR . 600 Z P 27-11824 B. F. 777 T. LOX TX ULG STA 540 3. 11. 33. 150. 1050 DGR AS SLO. CR/CR . 600 Z P 27-11824 B. F. 777 T. LOX TX ULG STA 540 3. 11. 33. 150. 1050 DGR AS SLO. CR/CR . 600 Z P 27-11824 B. F. 777 T. LOX TX ULG STA 540 3. 11. 33. 150. 1050 DGR AS SLO. CR/CR . 600 Z P 27-11824 B. F. 777 T. LOX TX ULG STA 540 3. 11. 37. 150 1050 DGR AS SLO. CR/CR . 600 Z P 27-11824 B. F. 777 T. LOX TX ULG STA 540 3. 11. 37. 150 1050 DGR AS SLO. CR/CR . 600 Z P 27-11824 B. F. 778 T. LOX TX ULG STA 540 3. 11. 31. 50. 1050 DGR AS SLO. CR/CR . 600 Z P 27-11824 B. F. 778 T. LOX TX ULG STA 540 3. 11. 31. 50. 1050 DGR AS SLO. CR/CR . 1088.3 P. 21-11824 A. 449, T. E. ALG POD IRSUL IN . 3. 11. 41. 50. 1050 DGR AS SLO. CR/CR . 1088.3 P. 21-11824 A. 449, T. E. ALG POD IRSUL IN . 3. 11. 41. 50. 1050 DGR AS SLO. CR/CR . 1099 Z P 27-								
### P TOP T SEG COMMUSTOR 3 11 9 0.1500 DGF SLO 27 01247 3 104L 1224.8 27-11726 #### A AB2.TL #1 A16 POD INSUL OUT 3 11 11 500 1500 DGR 40 SLO CR/CR 1012.2 27-11846 #### A AB3.TL #1 A16 POD INSUL OUT 3 11 13 500 1500 DGR 40 SLO CR/CR 1021.2 27-11846 #### A AB3.TL #1 A16 POD INSUL OUT 3 11 13 500 1500 DGR 40 SLO CR/CR 1021.2 27-11846 #### A AB3.TL #1 A16 POD INSUL OUT 3 11 19 500 1500 DGR 40 SLO CR/CR 1021.2 27-11846 #### A ABA.TL #1 A16 POD INSUL OUT 3 11 23 500 1500 DGR 40 SLO CR/CR 1086 2 27-11846 #### A AB2.TL #1 A16 POD INSUL OUT 3 11 23 500 1500 DGR 40 SLO CR/CR 1086 2 27-11846 #### A AB2.TL #1 A16 POD INSUL OUT 3 11 23 500 1500 DGR 40 SLO CR/CR 1086 3 27-11846 #### A AB2.TL #1 A16 POD INSUL OUT 3 11 23 500 1500 DGR 40 SLO CR/CR 1086 3 27-11846 #### A AB2.TL #1 A16 POD INSUL OUT 3 11 23 500 1500 DGR 40 SLO CR/CR 1086 3 27-11824 #### A AB2.TL #1 A16 POD INSUL OUT 3 11 23 150 1050 DGR 48 SLO CR/CR 570 Z 27-11824 #### F 773 T LOX TX UUC STA 570 3 11 33 150 1050 DGR 48 SLO CR/CR 500 Z 27-11824 #### F 775 T LOX TX UUC STA 570 3 11 33 150 1050 DGR 48 SLO CR/CR 600 Z 27-11824 #### F 777 T LOX TX UUC STA 570 3 11 33 150 1050 DGR 48 SLO CR/CR 600 Z 27-11824 #### F 777 LOX TX UUC STA 570 3 11 33 150 1050 DGR 48 SLO CR/CR 600 Z 27-11824 #### F 777 LOX TX UUC STA 570 3 11 33 500 1050 DGR 48 SLO CR/CR 600 Z 27-11824 #### F 777 LOX TX UUC STA 770 3 11 43 500 1500 DGR 48 SLO CR/CR 600 Z 27-11824 #### A 491 T LOX TX UUC STA 570 3 11 43 500 1500 DGR 48 SLO CR/CR 600 Z 27-11824 #### A 491 T LOX TX UUC STA 590 3 11 43 500 1500 DGR 48 SLO CR/CR 1086 3 27-11824 #### A 491 T LOX TX UUC STA 590 3 11 43 500 1500 DGR 48 SLO CR/CR 1090 Z 27-11824 #### A 491 T LOX TX UUC STA 590 3 11 43 500 1500 DGR 48 SLO CR/CR 1090 Z 27-11824 #### A 491 T							Ī	
A .A82.T. #1.A1G POD INSUL DUT. 3 11.11. 500 1500 DGR	į.						į	
A. ABS.T. #1_A1G_PQG_IBSUL IN 3.11.12. 500.1500.DGR *0.SLO. CR/CN 1012.2 P 27-11846 A. AB.T. #2_A1G_PQG_IBSUL OUT 3.11.15. 500.1500.DGR *0.SLO. CR/CN 1051.2 P 27-11846 A. ABS.T. #2_A1G_PQG_IBSUL OUT 3.11.17 500.1500.DGR *0.SLO. CR/CN 1051.2 P 27-11846 A. ABA.T. #2_A1G_PQG_IBSUL OUT 3.11.19 500.1500.DGR *0.SLO. CR/CN 1088.2 P 27-11846 A. ABZ.T. #3_A1G_PQG_IBSUL IN 3.11.21 500.1500.DGR *0.SLO. CR/CN 1088.2 P 27-11846 A. ABZ.T. #3_A1G_PQG_IBSUL OUT 3.11.23 500.1500.DGR *0.SLO. CR/CN 1088.3 P 27-11846 A. ABZ.T. #3_A1G_PQG_IBSUL OUT 3.11.23 500.1500.DGR *0.SLO. CR/CN 1088.3 P 27-11846 A. ABZ.T. #3_A1G_PQG_IBSUL OUT 3.11.23 500.1500.DGR *0.SLO. CR/CN 1088.3 P 27-11846 A. ABZ.T. #3_A1G_PQG_IBSUL OUT 3.11.23 500.1500.DGR *0.SLO. CR/CN 1088.3 P 27-11846 A. ABZ.T. #3_A1G_PQG_IBSUL OUT 3.11.23 500.1500.DGR *0.SLO. CR/CN 5.00.2 P 27-11826 B. F. 773_T. LOX TX_ULG_STA 500.3 11.31 150.1050.DGR *0.SLO. CR/CN 5.00.2 P 27-11826 B. F. 773_T. LOX TX_ULG_STA 500.3 11.33 150.1050.DGR *0.SLO. CR/CN 5.00.2 P 27-11826 B. F. 773_T. LOX TX_ULG_STA 600.3 11.30 150.1050.DGR *0.SLO. CR/CN 600.2 P 27-11826 B. F. 773_T. LOX TX_ULG_STA 600.3 11.30 150.1050.DGR *0.SLO. CR/CN 600.2 P 27-11826 B. F. 773_T. LOX TX_ULG_STA 600.3 11.30 150.1050.DGR *0.SLO. CR/CN 600.2 P 27-11826 B. F. 773_T. LOX TX_ULG_STA 600.3 11.30 150.1050.DGR *0.SLO. CR/CN 600.2 P 27-11826 B. F. 773_T. LOX TX_ULG_STA 600.3 11.30 150.1050.DGR *0.SLO. CR/CN 1004.2 P 27-11826 A. 490_T. #4_A1G_PGO_IBSUL IR. 5.11.45 500.1500.DGR *0.SLO. CR/CN 1004.2 P 27-11826 A. 490_T. #4_A1G_PGO_IBSUL IR. 5.11.45 500.1500.DGR *0.SLO. CR/CN 1004.2 P 27-11826 B. F. 776_T. LOX TX_ULG_STA 600.3 11.35 1.50.1500.DGR *0.SLO. CR/CN 1004.2 P 27-11826 B. F. 776_T. LOX TX_ULG_STA 600.3 11.45 1.50.1550.DGR *0.SLO. CR/CN 1004.2 P 27-11826 B. F. 776_T. LOX TX_ULG_STA 600.3 11.45 1.50.1050.DGR *0.SLO. CR/CN 1004.2 P 27-11826 B. F. 776_T. LOX TX_ULG_STA 600.3 11.35 1.50.1050.DGR *0.SLO. CR/CN 1004.2 P 27-11826 B. F. 776_T. LOX TX_ULG_STA 600.3 11.35 1.50.1050.DGR *0.SLO. CR/CN 1004.2 P 27-1		· -						
A. AL.T. #2 AIG POD INSUL DUT. 3.11. 15. 500. 1500. DGR. 40 SLO. CR/CR 1051. 2. P 27-11846 A. ABAT. #2 AIG POD INSUL IN 3.11. 17 500. 1500. DGR. 40 SLO. CR/CN 1058. 2. P 27-11846 A. ABAT. #3 AIG POD INSUL IN 3.11. 21 500. 1500. DGR. 40 SLO. CR/CN 1068. 2. P 27-11846 A. ABT. #3 AIG POD INSUL DUT. 3.11. 23 500. 1500. DGR. 40 SLO. CR/CN 1068. 2. P 27-11846 A. ABT. #3 AIG POD INSUL DUT. 3.11. 23 500. 1500. DGR. 40 SLO. CR/CN 1086. 3. P 27-11846 A. ABT. #4 AIG POD INSUL DUT. 3.11. 25 500. 1500. DGR. 40 SLO. CR/CN 1086. 3. P 27-11846 A. ABT. #4 AIG POD INSUL DUT. 3.11. 25 500. 1500. DGR. 40 SLO. CR/CN 1086. 3. P 27-11846 B. F. 773. T. LOX TK ULG STA 540. 3.11. 31 150. 1050. DGR. 48 SLO. CR/CN 570. Z P 27-11824 B. F. 775. T. LOX TK ULG STA 400. 3.11. 32 150. 1050. DGR. 48 SLO. CR/CN 600. Z P 27-11824 B. F. 777. T. LOX TK ULG STA 400. 3.11. 37 150. 1050. DGR. 48 SLO. CR/CN 600. Z P 27-11824 B. F. 778. T. LOX TK ULG STA 400. 3.11. 37 150. 1050. DGR. 48 SLO. CR/CN 600. Z P 27-11824 B. F. 779. T. LOX TK ULG STA 400. 3.11. 37 150. 1050. DGR. 48 SLO. CR/CN 600. Z P 27-11824 B. F. 779. T. LOX TK ULG STA 400. 3.11. 39 150. 1050. DGR. 48 SLO. CR/CN 700. T20. Z P 27-11824 B. F. 779. T. LOX TK ULG STA 400. 3.11. 39 150. 1050. DGR. 48 SLO. CR/CN 700. T20. Z P 27-11824 A. 649. T. 64 AIG POD INSUL IN 3.11. 43 500. 1500. DGR. 40. SLO. CR/CN 1086. 1 P 27-11824 A. 649. T. 64 AIG POD INSUL IN 3.11. 43 500. 1500. DGR. 40. SLO. CR/CN 1086. 1 P 27-11844 A. 649. T. 64 AIG POD INSUL IN 3.11. 47 500. 1500. DGR. 40. SLO. CR/CN 1086. 1 P 27-11844 A. 649. T. 65 AIG POD INSUL IN 3.11. 47 500. 1500. DGR. 40. SLO. CR/CN 1086. 1 P 27-11844 A. 649. T. 65 AIG POD INSUL IN 3.11. 47 500. 1500. DGR. 40. SLO. CR/CN 1086. 1 P 27-11844 A. 649. T. 65 AIG POD INSUL IN 3.11. 47 500. 1500. DGR. 40. SLO. CR/CN 1086. 1 P 27-11844 A. 649. T. 65 AIG POD INSUL IN 3.11. 49 500. 1500. DGR. 40. SLO. CR/CN 1086. 1 P 27-11844 A. 649. T. 65 AIG POD INSUL IN 3.11. 49 500. 1500. DGR. 40. SLO. CR/CN 1086. 1 P 27-11844 B. F. 776. T. LOX TK ULG STA 490.								
A. 683.T. #2 AIG POD INSUL IN 3.11.17 500.1900.DGR. 40 SLO CR/CN 1088.2. # 27-11846 A. AAA.T. #. AIG POD INSUL OUT.3.11 19 500 1900.DGR. 40 SLO CR/CN 1088.2. # 27-11846 A. 688.T. #9 AIG POD INSUL OUT.3.11.23 500 1900.DGR. 40 SLO CR/CN 1088.3. # 27-11846 A. 688.T. #9 AIG POD INSUL OUT.3.11.23 500 1900.DGR. 40 SLO CR/CN 1088.3. # 27-11846 A. 688.T. #9 AIG POD INSUL OUT.3.11.23 500 1900.DGR. 40 SLO CR/CN 1088.3. # 27-11846 B. # 773.T. LOX TK ULG STA 540 3.11.31 150 1050.DGR. 48 SLO CR/CN 570 Z. # 27-11824 B. # 774.T. LOX TK ULG STA 600 3.11.32 150 1050.DGR. 48 SLO CR/CN 570 Z. # 27-11824 B. # 777.T. LOX TK ULG STA 600 3.11.37 150 1050.DGR. 48 SLO CR/CN 600 Z. # 27-11824 B. # 740.T. LOX TK ULG STA 600 3.11.39 150 1050.DGR. 48 SLO CR/CN 600 Z. # 27-11824 B. # 777.T. LOX TK ULG STA 600 3.11.39 150 1050.DGR. 48 SLO CR/CN 600 Z. # 27-11824 A. 649.T. #4 AIG POD INSUL IN 3.11.43 500 1050.DGR. 48 SLO CR/CN 78.T. # 27-11824 A. 649.T. #4 AIG POD INSUL IN 3.11.43 500 1050.DGR. 48 SLO CR/CN 1084.3. # 27-11844 A. 490.T. #5 AIG POD INSUL IN 3.11.43 500 1050.DGR. 48 SLO CR/CN 1084.3. # 27-11844 A. 491.T. #5 AIG POD INSUL IN 3.11.43 500 1050.DGR. 48 SLO CR/CN 1094.2. # 27-11844 A. 491.T. #5 AIG POD INSUL IN 3.11.43 500 1050.DGR. 48 SLO CR/CN 1094.2. # 27-11844 A. 491.T. #5 AIG POD INSUL IN 3.11.43 500 1050.DGR. 48 SLO CR/CN 1094.2. # 27-11844 A. 491.T. #5 AIG POD INSUL IN 3.11.43 500 1050.DGR. 48 SLO CR/CN 1094.2. # 27-11844 B. # 777.T. LOX TK ULG STA 491 \$11.51 \$10.1050.DGR. 48 SLO CR/CN 1094.2. # 27-11844 A. 491.T. #5 AIG POD INSUL IN 3.11.51 \$10.1050.DGR. 48 SLO CR/CN 1094.2. # 27-11844 B. # 777.T. LOX TK ULG STA 491 \$11.53 \$10.1050.DGR. 48 SLO CR/CN 1094.2. # 27-11844 B. # 777.T. LOX TK ULG STA 491 \$11.53 \$10.1050.DGR. 48 SLO CR/CN 1094.2. # 27-11844 B. # 777.T. LOX TK ULG STA 491 \$11.53 \$10.1050.DGR. 48 SLO CR/CN 1094.2. # 27-11844 B. # 777.T. LOX TK ULG STA 491 \$11.53 \$10.1050.DGR. 48 SLO CR/CN 1094.2.							I	
A. ABB. T. B. ALG POD LESUL GUT. 3 11 19 500 1500 DGR 40 SLO. CR/CN 1068.2. P 27-11846 A. ABZ. T. B. ALG POD LESUL DUT. 3 11 21 500 1500 DGR 40 SLO. CR/CN 1068.2. P 27-11846 A. ABZ. T. B. ALG POD LESUL DUT. 3 11 23 500 1500 DGR 40 SLO. CR/CN 1086.3. P 27-11846 A. ABZ. T. B. ALG POD LESUL DUT. 3 11 23 500 1500 DGR 40 SLO. CR/CN 1086.3. P 27-11846 A. ABZ. T. B. ALG POD LESUL DUT. 3 11 25 500 1500 DGR 48 SLO. CR/CN 540.2. P 27-11846 B. F. 773 T. LOX TK ULG STA 540 3 11 31 150 1050 DGR 48 SLO. CR/CN 570.2. P 27-11824 B. F. 774 T. LOX TK ULG STA 600 3 11 39 150 1050 DGR 48 SLO. CR/CN 600.2. P 27-11824 B. F. 777 T. LOX TK ULG STA 640 3 21 37 150 1050 DGR 48 SLO. CR/CN 600.2. P 27-11824 B. F. 777 T. LOX TK ULG STA 640 3 21 37 150 1050 DGR 48 SLO. CR/CN 600.2. P 27-11824 B. F. 777 T. LOX TK ULG STA 770 3 11 39 150 1050 DGR 48 SLO. CR/CN 767 2. P 27-11824 B. F. 777 T. LOX TK ULG STA 787 3 11 41 150 1050 DGR 48 SLO. CR/CN 767 2. P 27-11824 A. 649 T. 64 ALG POD INSUL IR 3 11 43 500 1500 DGR 40 SLO. CR/CN 1086 3 P 27-11846 A. 490 T. 62 ALG POD INSUL IR 3 11 43 500 1500 DGR 40 SLO. CR/CN 1099 2. P 27-11846 A. 491 T. 65 ALG POD INSUL IR 3 11 47 501 1500 DGR 40 SLO. CR/CN 1099 2. P 27-11846 A. 492 T. ALG POD ARCIERT SKIN 3 11 49 500 1500 DGR 48 SLO. CR/CN 1099 2. P 27-11846 B. F. 776 T. LOX TK ULG STA 630 3 11 51 130 1050 DGR 48 SLO. CR/CN 1099 2. P 27-11846 B. F. 776 T. LOX TK ULG STA 640 3 11 57 100 1500 DGR 48 SLO. CR/CN 1099 2. P 27-11846 B. F. 776 T. LOX TK ULG STA 640 3 11 57 3 11 56 COMBECTED TO 3 11 56 3 11 57 3 11 58 COMBECTED TO 3 11 56 3 11 57 3 13 58 COMBECTED TO 3 11 56 3 11 57 3 13 58								
A ABT. IL BE AIG POD INSUL IN 3 11.21 500 1500 DGR 40 SLO CR/CH 1086.2 P 27-11846 A 488 T. 84 AIG POD INSUL OUT 3.11.23 500 1500 DGR 40 SLO CR/CH 1086.3 P 27-11846 1008 CALIB 3.11.27 98 CALIB 3.11.27 98 CALIB 3.11.25 B F 773 T LOX TR ULG STA 540 3 11.31 150 1050 DGR 48 SLO CR/CH 570 Z P 27-11826 F 774 T LOX TR ULG STA 600 3 11.32 150 1050 DGR 48 SLO CR/CH 600 Z P 27-11826 F 777 T LOX TR ULG STA 600 3 11.39 150 1050 DGR 48 SLO CR/CH 600 Z P 27-11826 F 777 T LOX TR ULG STA 600 3 11.39 150 1050 DGR 48 SLO CR/CH 600 Z P 27-11826 F 777 T LOX TR ULG STA 600 3 11.39 150 1050 DGR 48 SLO CR/CH 600 Z P 27-11826 F 770 T LOX TR ULG STA 770 3 11.39 150 1050 DGR 48 SLO CR/CH 600 Z P 27-11826 F 770 T LOX TR ULG STA 787 3 11.41 150 1050 DGR 48 SLO CR/CH 600 Z P 27-11826 A 649 T 64 AIG POD INSUL IN 3.11.43 500 1500 DGR 48 SLO CR/CH 1086 3 P 27-11826 A 690 T 62 AIG POD INSUL IN 3.11.43 500 1500 DGR 40 SLO CR/CH 1086 3 P 27-11846 A 691 T 69 AIG POD INSUL IN 3.11.45 500 1500 DGR 40 SLO CR/CH 1089 Z P 27-11846 A 694 T AIG POD ARCIENT SKIN 3.12.49 500 1500 DGR 40 SLO CR/CH 1089 Z P 27-11846 A 694 T AIG POD ARCIENT SKIN 3.12.49 500 1500 DGR 40 SLO CR/CH 1089 Z P 27-11846 F 776 T 101 TR ULG STA 690 3.11.51 150 1050 DGR 48 SLO CR/CH 500 TDR 2 P 27-11846 F 776 T 107 TR ULG STA 691 3.11.55 150 1050 DGR 48 SLO CR/CH 500 TDR 2 P 27-11846 COMMECTED TO 3.11.56 3.11.57 COMMECTED TO 3.11.58 3.11.51 500 1050 DGR 48 SLO CR/CH 500 TDR 2 P 27-11826								
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REPORT NO. AZC-27-059-16 SECTION 9 8 MARCH 1961

MISSILE INSTRUMENTATION LOG SHEET 10 AZC-27-059-16 PAGE TELEMETER NO STATION DESCRIPTION NUMBER SYNC & 1008 CALIB 3, 12, 55 COMMECTED TO 3 12 55:3, 12:56 CONNECTED TO 3 12 57 3 12 58 COMMECTED TO 3 12 58.3.12.59

THIS MILTERIAL CONTRAINS INFORMATIVE MEETING, HAS INFORMAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS, TITLE IN U.S. SECTIONS FOR AND FOR THE MASSING OF REVELOTION OF REVE





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MISSILE INSTRUMENTATION LOG SHEET REPORT NO AZC-27-659-16 DATE CE MAR 61 MISSILE_ PAGE S. CLCARRIER WO COMMUTATOR RATE OF CHANGE OR FREQUENCY OF FUNCTION UNITS FAMCTION TELEMETE NO CARP CODE ACCUBACY SER! AL STATION DESCRIPTION NUMBERS ő low 14 16 17 13 M 42 41 46 44 49 49 51 22 52 54 55 54 57 54 57 69 51 42 ACCELEBONETER ZF1 A ACCELERONETER YES A MACCEL AFT DIRECT 3 6 M12 12 524 A ACCEL MEZ DIRECT 111

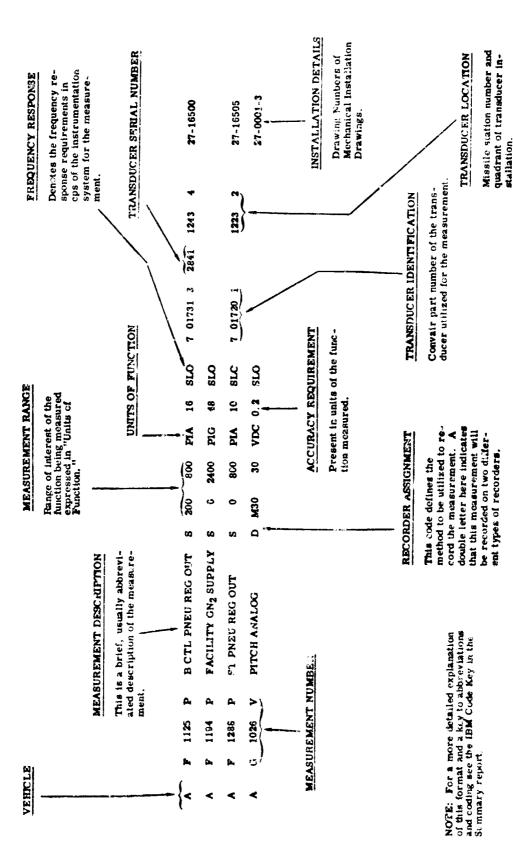
> THIS MATERIAL CONTAINS IMPORMATION AFFECTION THE NATIONAL DEFENSE OF THE UNITED STATES WISHING THE MEANING OF THE ESPICIAGE LAND, TITL LE, U.S.C., SECTIONS 793 AND 774, THE TRANSMISSION OF REVELATION OF WHICH IN ANY MAKEER TO AR UNMUTHORIZED PERSON IS PROMINIFED BY LAW



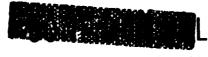
The Landline Instrumentation presented in this section contains the latest available characteristics of the individual measurements. In addition the type of recordings indicated.

LANDLINE INSTRUMENTATION

SECTION 10



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REPORT NO. AZC-27-059-16

SECTION 10

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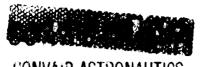


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REPORT NO. AZC-27-059-15

SECTION 10

8 MARCH 1961

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REPORT NO. AZC-27-059-16 SECTION 10 8 MARCH 1961

CONVAIR-ASTRONAUTICS

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MISTER NO AZ 7-27-050-17 BATE 22 August 1960

CONVAIR (ASTRONAUTICS) DIVISION GENERAL ETHANICS CORPORATION

WS-107A-1

INSTRUMENTATION CONFIGURATION

SERIES E ARTICLE 17

AMR

PREPARED BY TEST PLANNING



CO-CEDINATED BY 1418

APPROVED EN

H. R. Macdonald Test Planning

CHECKED BY M. L. Male

Instrumentation

APPROVED BY

Chief - Field Test

Engineering





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REVISIONS

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A	11 Mar 16	WSB	ADDITIONS:	ALL TABS
			A933T, A93LT, A935T, F1309D, F1301P,	
			F1302P, H130P, H185P, H191P, H212P,	
			н224Р, н1360Р, н1187х, н1188х, 11606V,	
			P14520, P14530, P1020T, P1054T.	
			REASONS FOR REVISION "A" CHANGES	l _i -1
A	Ilı Mar '6	WSB	DELETIONS:	ALL TARS
*			11603X, 11604X, 11605X, N1314T, P1010P,	
			P1011P, P1232P, P1465P, P1709T, P1713T,	
			P1714T, P1226X, P1227X, F1228X, P1785X,	
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PAGE NO. i

14 MARCH 1961

FOREWORD

This report has been published in accordance with contractual requirements as cited in Convair-Astronautics Report AM-7-289. It describes the instrumentation released for Missile 17-E as of 14 March 1961.

Information presented here will be used by Air Force, Associate Contractors, Design, Operation and Field Test Groups. Measurement modification will either originate in the Instrumentation Section of the Test Planning Group or will be submitted as a recommendation to this group.

Ä



PAGE NO. iii

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SUMMARY	1-1
REASONS FOR REVISION "A" CHANGES	4-1
TABULATIONS	
Telemetered Measurements by System	8
Telemetered Measurements by Channel	9
Landline Instrumentation	10

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SUMMARY

The instrumentation configuration for this missile has been estiablished through a study of program test objectives, systems analysis, and operating considerations. A discussion of missile instrumentation and associated characteristics has been summarized in Report AZC-27-059. For a detailed description of the various missile systems, test objectives, and general test program, see Report AE60-0438.

The specific measurements to be transmitted via telemeter have been tabulated and are listed in Sections 8 and 9 in terms of instrumentation systems and telemeter channel assignments.

In addition to the telemetry, the landline instrumentation program for this missile has been included in this report in the form of a master tabulation of landline measurement characteristics, (Section 10).

To clarify specific measurements, instrumentation location schematics have been included in Report AZC-27-059, Section 7.

There are a total of 175 telemetered measurements on 41 channels in this missile divided as follows:

	ACCEL	DEFL	POS	PRES	TEMP	VOLT	DIS POS	MISC	TOTAL
A/FRAME					32				32
PNEU				4	2				6
GUID						2		2	4
HYD				7					7
INER GUID	6	4	5	1	5	11	8	5	45
PROP		2		20	5		S	3	33
A/P SYS		13					1	3	17
MISC	1	1		2	2	7	14	4	31
TOTAL	7	20	5	34	46	20	26	17	175

There are also 167 measurements recorded and displayed via 167 landline channels.

THIS MATERIAL CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIDNAGE LAWS, TITLE 18, U.S.C., SECTIONS 793 AND 794, THE TRANSMISSION OR REVELATION OF WHICH IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW.

CALENDA

PAGE NO. 4-1

14 MARCH 1931

REASONS FOR REVISION "A" CHANGES

I. Data obtained from the following temperature measurements will reveal total heating rates, relative heating intensity of a hot spot between the engines, the relative heating intensities of the outer and inner heat shield peripheries, and model scaling laws applicable to recirculation predictions.

MEAS NO. DESCRIPTION

ADD

A933T AEDC AFT SHIELD CALOR
A934T AEDC AFT SHIELD CALOR
A935T AEDC AFT SHIELD CALOR

- II. Computer Reset I1606V. demonstrates the start of computer cycling; it is a convenient initial operating time reference to be used with measurement I1510W, ELAPSED TIME.
- III. The booster engine LOX pump inlet temperatures (P1020T, P1054T) will be monitored by the regular landline instrumentation system during the launch countdown. This information will assure that turbopump starting NPSH requirements are satisfied and determine the adequacy of the LOX topping and slug systems.
- IV. To provide higher quality data during the critical portions of launch, and supply booster engine rough combustion data for the first 15 feet of missile travel, two (2) accelerometer measurements will be monitored via trailing wire umbilical.

MEAS NO.

DESCRIPTION

ADD

P1452O

B1 NAA RCC ACCEL

P14530

B2 NAA RCC ACCEL

PAGE NO. 4-2



14 MARCH 1961

V. To provide sufficient data to analyze the performance of the airborne hydraulic system, the following instrumentation has been added:

MEAS NO.	DESCRIPTION	CHANNEL
ADD		
H130P	S HYD PUMP DISCH	1.13.1
H185P	S HYD PUMP INLET	1.12.9
H191P	S HI PP TO MANIFOLD	1.12.31
H212P	VERNIER RETURN	2.11.51
H224P	B HYD SYS LO PRESS	2.11.53
H1360P	HPU SUSTAINER RETURN	
H1187X	BSTR OIL EVACUATION	
H1188X	SUST OIL EVACUATION	

- VI. Due to the complexity in making and calibrating measurement Z2E, KLYSTROM PW OUTPUT, it has been deleted.
- VII. The roll program is accomplished by ARMA signal, which function is monitored by measurement I529W. Therefore measurement S1649X, PROGRAMMER ROLL SIGNAL has been deleted.
- VIII. Because there is no further test data needed on LOX slug transfer units at AMR, measurement N1314T, SLUG CHG LO₂ DISC has been deleted.
- IX. ARMA reevaluation indicates that these measurements will not provide the data originally required. Therefore they are deleted.

DELETE

I1603X WORD GATE FIVE
I1604X MULT GATE SIX
I1605X 112 CPS GATE



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14 MARCH 1961

X. These measurements, applicable only on FRF missiles, have been deleted on 17-E.

MEAS NO.	DESCRIPTION
DELETE	
₽1010P	BI LUBE OIL INJ MAN
P1011P	B2 LUBE OIL INJ MAN
P1232P	S LO ₂ SEAL CAVITY
P1465P	S LO PR LUBE OIL MAN
P1227X	LOX DOME PURGE
P1228X	IGNITER FUEL PURGE
P1785X	B SECONDARY SHUTDOWN
P1226X	PNEUMATICS CUTOFF
P1709T	SGG COMBUSTOR
P1713T	B1 GAS GEN CUTOFF
P1714T	B2 GAS GEN CUTOFF



CONVAIR-ASTRONAUTICS

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MISSILE INSTRUMENTATION BY SYSTEM

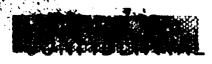
ECTION 1

The Missile instrumentation Log presented in this section contains the latest available characteristics of the individual measurements. In addition, the telemetering channel assignments are included. Note that this section is listed by system.

INSTALLATION DETAILS 27-11608 27-11609 27-16500 27-11600 27-16505 Drawing Numbers of Mechanical Installation Drawings. Missile stat.o. number and quad ant of transducer in-TRANSDUCER LOCATION ۵, ۵, Convair, art number of the transducer utilized for the measurement. TRANSD' CER IDENTIFICATION ~ > ~ stallation. 4 1243 1238 1223 **4**80 925 Ξ 13 01731 7 01723 01723 7 01727 7 01727 UNITE OF FUNCTION 815 85 810 810 85 sponse requirements of the instramentation system for the measurement. Denotes the frequency re-FREQUENCY RESPONSE Range of interest of the function being measured expressed in 'Talts of Function." MEASUREMENT PANCE Z PIA Z ¥ 젍 **£**3 8 415 415 8 22 0 0 2 0 œ ۳-1 Ξ 5 11 = **:** == 11 Indicate the telemeter, subcarrier and pin number assignment for the applicable measurement. This is a brief, usually abbrevi-ated, description of the measure-ment. TELEMETRY CHANNEL ASSIGNMENT MEASUREMENT DESCRIPTION _ B TANK HE BOTTLES LO 8 TANK HE BOTTLE LO B C IL PNEU REG OUT FUEL TANK HELLUM 1.02 TANK HELLUM MEASUREMENT NUMBER p, ۵, 4 ۵, ۵, • 8 3 ij VERBCLE _ . < <

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NOTE: For a more detailed explanation of this format and a key to abbreviations and coding see the IBM Code Key in the Summary report.



SECTION 8

14 MARCH 1961

CONVAIR ASTRONAUTICS

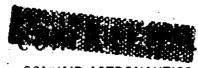
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			4 7 4		4 4	13	(4 1 14 14 14 14 14 14 1	1
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	THE STATE OF THE S		45 E	COM NITH	04 MG	FRANSDUCER	*O *O 3	An mates
		- 11	MM Ed E M	B 10 7 41 41	4 4 6 6 7 10	U MM66751 We	141 42 44 47 78 7	
	A	AIRFRAME						
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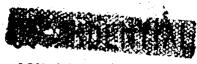
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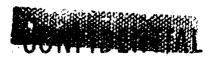
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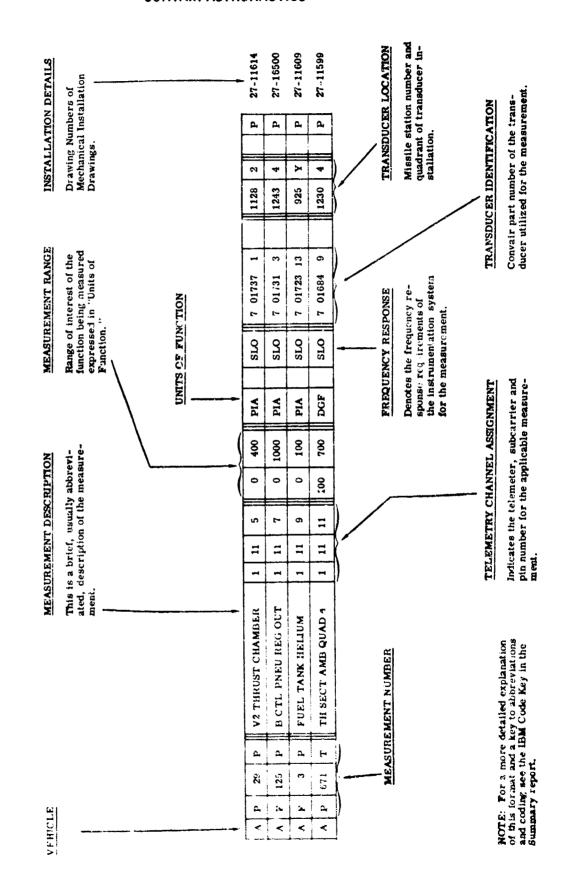


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SECTION 9

MISSILE INSTRUMENTATION BY CHANNEL

The Missile Instrumentation Log presented in this section contains the latest available characteristics of the individual measurements. In addition, the telemetering channel assignments are included. Note that this section is listed by channel.



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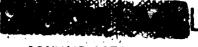
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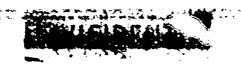
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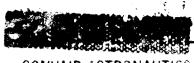
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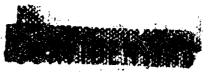
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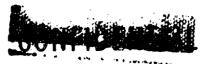
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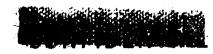
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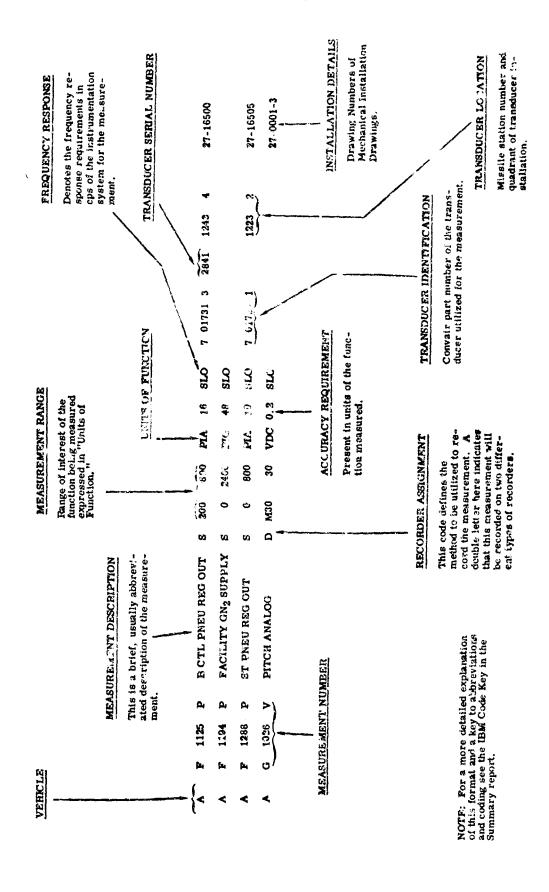
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## SECTION 10

## LANDLINE INSTRUMENTATION

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SECTION 10

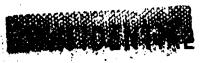
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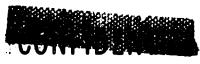
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SECTION 10

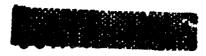
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#### **CONVAIR-ASTRONAUTICS**

MISSILE 17E L/L REPORT NO. AZC-27-059-17 DATE PAGE 6										()							
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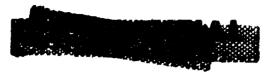
**REPORT NO. AZC-27-059-17** 

SECTION 10

14 MARCH 1961

MISSILE INSTRUMENTATION LOG SHEET REPORT NO AZC-27-059-17 17E L/L MISSILE DATE PAGE DESCRIPTION MUMBERS ð T 5160 V TLM 3 FIL INT DC T 5161 V THE 3 FIL EXT DO T 5150 W TEN #1 TOTAL 0 1000 HR T 5151 W TLM #2 TOTAL 0 1000 HR T 5152 W TLM #3 TOTAL 0 1000 HR T 5153 W TLM #1 BAT TIMER F T 5154 W TLM #2 BAT TIMER . P T 5155 W TLM #1 BATTERY 60 MIN Ų PROPELLANT UTILIZ U 1091 V ERROR RATIO DEMOD OP . M20 U 1200 X 1002 1008 SLUG COF-1 OFF STP PEN 72 P U 1201 X LOZ TOPG HI CTL-1 P VDC STP PEN 70 U 1202 X LO2 TOPG LO CTL-1 STP OFF VOC PEN 68 P U 1203 X LOZ 95% RAPID LOAD-1 OFF ON VDC STP FEN . U 1204 X FUEL 100% SEC CTL VDC 5 T P • PEN 65 U 1205 X FUEL 1008 PRI CTL P VDC STP U 1206 X FUEL 95% SEC CTL P VDC PEN U 1207 X FUEL 95% PRI CTL VDC þ U 1208 X LO2 100% SLUG COF-2 VOC 73 U 1209 x LOZ TOPG HI CTL-2 U 1210 X LOZ TOPG LO CTL-2 VDC. ,





CONVAIR (ASTRONAUTICS) DIVISION GENERAL DYNAMICS CORPORATION

MATE 16 March 1961

WS-107A-1

INSTRUMENTATION CONFIGURATION

SERIES E ARTICLE 18

**AMR** 

APR LIBRARY

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CHECKED BY T.M.

T. M. Wooster

instrumentation

APPROVED BY

P. J. Loch

Chief - Field Test

Engineering

**ASTRONAUTICS** 

#### REVISIONS

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A	16 Mar '61	WSB	ADDITIONS:	ALL TARS
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			713090, F3LP, F212P, F1301P, F1302P,	
			F17T, F371T, F37LT, F375T, F376T,	
			F377T, F771T, F773T, F77UT, F775T,	
			f776t, f777t, f780t, f781t, f782t,	
			H130P, H185P, H191P, H212P, H22LP,	
			H1360P, H1187X, H1188X, I1606V,	
			N1.356x, N1.932x, N1.933x, N1.97.9x,	
		P12060, P12080, P12090, P1001P, P1002P,		
			P1003P, P100LP, P1091P, P1092P, P1093P,	
			P1094P, P1020T, P1054T, H414F, U409V.	
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### CONFIDENTIAL REPORT NO. AZC-27-059-18 CONVAIR ASTRONAUTICS PAGE NO. 1

16 MARCH 1961

#### FUREWORD

This report has been published in accordance with contractual requirements as cited in Convair-Astronautics Report ZM-7-289. It describes the instrumentation released for Missile 18-E as of 16 March 1961.

A

Information presented here will be used by Air Force, Associate Untractors, Design, Operation, and Field Test Groups. Measurement modification will either originate in the Instrumentation Section of the Test Planning Group or will be submitted as a recommendation to this group.

THIS MATCRIAL CONTAINS INFORMATION AFFOCTING THE MATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS, TITLE 18, 6.5.C. SECTIONS 793, AND 794. THE 10. PISMISSION OF REVELATION OF WHICH IN ANY MANNER TO AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW.



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#### **SUMMARY**

The instrumentation configuration for this missile has been established through a study of program test objectives, systems analysis, and operating considerations. A discussion of missile instrumentation and associated characteristics has been summarized in Report AZC-27-059. For a detailed description of the various missile systems, test objectives, and general test program see Report AE60-0442.

The specific measurements to be transmitted via telemeter have been tabulated and are listed in Sections 8 and 9 in terms of instrumentation systems and elemeter channel assignments.

In addition to the telemetry, the landline instrumentation program for this missile has been included in this report in the form of a master tabulation of landline measurement characteristics, (Section 10).

To clarify specific measurements, instrumentation location schematics have been included in Report AZC-27-059, Section 7.

There are a total of 205 telemetered measurements on 41 channels in this missile divided as follows:

_	ACCEL	DEFL	POS	PRES	TEMP	VOLF	DIG. POS	MISC	TOTAL	
A/FRM					34			5	39	
PNEU		l i	,	. 8	19		1		27	
GUID	:	<u>}</u>	;		a, they	2	<b></b>	2	4	
HYD				7	•	!			7	
INER. GUID	6	4	5	1	5	11	8	5	45	
PROP		2		20	5		3	3	33	
A/P SYS		13					2	3	18	
MISC	1	1		2	2	8	14	4	32	
TOTAL	7	20	5	38	65	21	27	22	205	

There are also 181 measurements recorded and displayed via 181 landline channels.

THIS MATERIAL CONTAINS INFORMATION AFFECTING THE NATIONAL DEFENSE OF THE UNITED STATES WITHIN THE MEANING OF THE ESPIONAGE LAWS, TITLE 18, U.S.C., SECTIONS 793 AND 794, THE TRANSMISSION OF REVELATION OF WHICH IN ANY MANNER OF AN UNAUTHORIZED PERSON IS PROHIBITED BY LAW

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#### REASONS FOR REVISION "A" CHANGES

I. Data obtained from the following temperature measurements will reveal total heating rates, relative heating intensity of a hot spot between the engines, the relative heating intensities of the outer and inner heat shield peripheries, and model scaling laws applicable to recirculation predictions.

MEAS NO. DESCRIPTION

ADD

A933T AEDC AFT SHIELD CALOR
A934T AEDC AFT SHIELD CALOR
A935T AEDC AFT SHIELD CALOR

- II. It is important to know the weight of LOX boiloff during flight for accurate evaluation of the over-all effect on missile performance resulting from the removal of intermediate bulkhead insulation. Seventeen (17) temperature and 2 pressure measurements have been added to provide this data.
- III. Four measurements have been added to determine that proper sequencing of the LOX slug transfer valves occurs.

DESCRIPTION

ADD SIG CHG LO $_2$  LOW LEVEL N1932X LO $_2$  TPNG VLV CLOSED N1933X LO $_2$  TPNG VLV OPEN PRESS VLV CLOSED

MEAS NO.

IV. Computer Reset I1606V, demonstrates the start of computer cycling; it is a convenient initial operating time reference to be used with measurement I1510W, ELAPSED TIME.

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V. Due to the free launch configuration, the E Series missile lifts off the pad when the engine thrust reaches approximately 60% of nominal and the engine start sequence is still incomplete. In order to obtain continuous, high frequency response data during the entire engine start sequence for failure and performance analysis purpose, a trailing wire instrumentation umbilical will be provided.

The trailing umbilical will be attached to the missile for at least ten feet of vertical travel and supply data for a minimum of three seconds after engine start. The data will be recorded on a FM magnetic tape to allow the highest frequency response and most comprehensive data reduction methods to be utilized. The selected measurements that will be transmitted via the trailing umbilical are: Accelerometers to be mounted on booster (P1208O, P1209O) and sustainer (P1206O) engine LOX domes to detect excessive engine vibration caused by combustion instability, propellant surges, and other transient phenomena, pressure instrumentation in the booster engine LOX (P1001P, P1003P) and fuel (P1002P, P1004P) turbopump inlets to establish interface requirements, propellant ducting integrity, and turbopump performance, booster high pressure propellant ducting integrity, main propellant valve operation, turbopump action, and engine transient behavior to be detected by pressure measurement in the booster LOX (P1091P, P1092P) and fuel (P1093P, P1094P) injection manifold.

The booster engine LOX pump inlet temperatures (P1020T, P1054T) will be monitored by the regular landline instrumentation system during the launch countdown. This information will assure that turbopump starting NPSH requirements are satisfied and determine the adequacy of the LOX topping and slug systems.

VI. The following measurements are part of the "E Series" pneumatic regulator study. The purpose of the measurements is to obtain accurate inflight data of vibrational input at the regulator mounting base and on the regulator. This data will be used to supplement laboratory testing to establish vibrational specification.

MEAS NO.	DESCRIPTION
A781O	BASE LO ₂ TK P REG RAD
A7820	BASE LO ₂ TK P REG LG
A783O	BASE LO ₂ TK P REG TG
A925O	LO ₂ TK P REG LONG
A926O	LO ₂ TK P REG TANG

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The transducers are Gulton KA-1006 G systems, composed of an A-395 TMU-1 accelerometer and a FT-521 U amplifier. These are a piezoelectric type with a nominal sensitivity of 833 MV/G. The amplifier gain is variable from 5 to 50. The complete system sensitivity is flat to ± 3% over the temperature range of -30 to +185 DGF, and has a cross-axis sensitivity of less than 5%. The ranges are plus to minus 30 G's with frequency response to 1200 cps. The telemetering is being accomplished by the "burst technique" over channel C. The "burst technique" is implemented by connecting a series of commutator pins together. Channel C is commutated at 1/8 rps and the output from each accelerometer is monitored for approximately 1 second every 8 seconds.

VII. Due to the 13E failure, further instrumentation is required for the hydraulic and propellant utilization systems. Therefore measurement H414P, PU VLV CLS SERVO, and U409V, PU VALVE COMMAND VOLT have been added.

VIII. To provide sufficient data to analyze the performance of the airborne hydraulic system. the following instrumentation has been added:

MEAS NO.	DESCRIPTION	CHANNEL
ADD		
H130P	S HYD PUMP DISCH	1.13.1
H185P	S HYD PUMP INLET	1.12.9
H191P	S HI PP TO MANIFOLD	1.12.31
H212P	VERNIER RETURN	2.11.51
H224P	B HYD SYT LO PRESS	2 . 11 53
H1360P	HPU SUSTAINER RETURN	
H1187X	BSTR O'L EVACUATION	
H1188X	SUST OIL EVACUATION	

IX. The following measurements duplicate previously assigned numbers. Therefore, they are deleted

 DFLETE

 F92T
 LO2 CTR \$1 A 504

 F93T
 LO2 CTR \$TA 540

 F94T
 LO2 CTR \$TA 600

 F96T
 LO2 CTR \$TA 720

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X. These measurements, applicable only on FRF missiles, have been deleted on 18E.

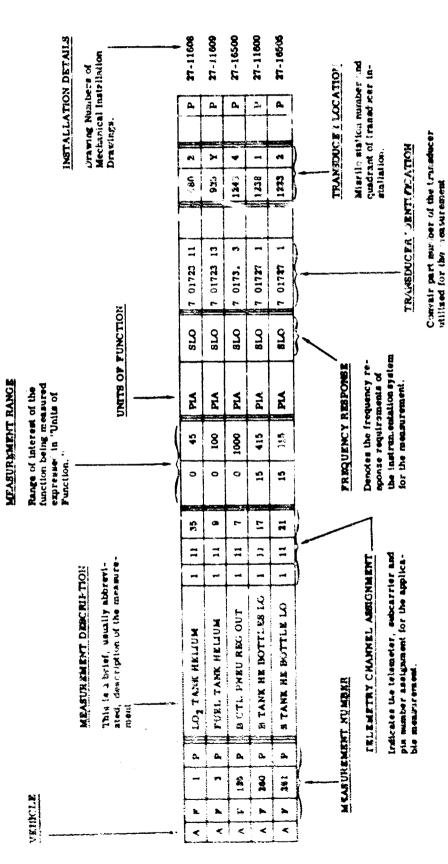
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P1228X	IGNITER FUEL PURGE
P1785X	B SECONDARY SHUTDOWN
P1226Y	PNEUMATICS CUTOFF

- XI. Due to the complexity in making and calibrating measurement Z2E, KLYSTROM PW OUTPUT, it has been deleted.
- XII. The roll program is accomplished by ARMA signal, which function is monitored by measurement I529V. Therefore measurement S1049X, PROGRAMMER ROLL SIGNAL has been deleted.
- XIII. Escause there is no further test data needed on LOX slug transfer units at AMR, measurement N1314T, SLUG CHG LO₂ DISC has been deleted.

## BECTION 9

## MISGLE INSTRUMENTATION BY STSTEM

The Missile instrumentation Log presented in this section contains the latest available characteristics of the individual measurements. In addition, the telepastering character assignments and included. Note that this section is listed by system.



DROTE: For a more detailed explanation of this forsist and a key to arbiteriations and coding see the IRM Code Key is the Bussmary roport.

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MISSILE INSTRUMENTATION LOG SHEET CONFINENTIAL

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SECTION 8

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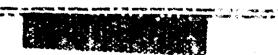
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# 197 P. LOZ PRESS CREC DP 1 A. ** 0 3 PID1 NO. 71 PIS 21 P. 2040 P. LOT 21 P. 27-11/792  # F 212 P FUEL PRESS CREC IN 2 11 37 40 77 PIS 21 SLO. 7 81893 7 P. 2440 P. 8 "AM. HE DOTTLES HI 1 12 53 0 3300 PIA 109 SLO. 7 81778 5 40405 11477.0 F. 27-1146.  # 17 T FUEL PRESS CREC IN 1 11.43 0 300 DEF 12 SLO. 7 81894 3		DESCRIPTION	S SALES		<b>9</b> 0		State of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control of the Control
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### 17.1   FUEL PRESS ORFC IN   111.03   0 300 DEF   12 SLO   7 01884   3   9				2 22 34			4.1993,7.4 <b>D</b> 4
## 17 1 FUEL PRESS ORFC IN 1 11-05 0 500 DBF 12 SLO 7 01886 3  ## 97.7 LOR TR. CTR STA 787 3 11-01 150 800 DBF 84 84.00 CR/CR 787/L P 27-11824  ## 113 1 LO2 PRESS REG IRLT 1 11 5 9 8200 260 DBF 84 84.00 CR/CR 78127 1293 9 77-11842  ## 113 1 LO2 PRESS ORFC IN 1 111-11 0 500 DBF 81.0 7 01886 3 144 11213 9 27-11722  ## 247 1 8 TAME ME BOTTLES 1 11.35 MORE NOR 1250 DBF 81.0 7 01886 3 144 11213 9 27-11842  ## 7 371 I LOX TE MAG STA 691 3 11.33 150 1050 DBF 81.0 T 01886 3 164 11271 9 27-11842  ## 7 372 T LOX TE MAG STA 807 3 11 1 150 1050 DBF 85.00 CR/CR 8512 2 27-11824  ## 7 373 T LOX TE MAG STA 807 3 11 3 150 1050 DBF 85.00 CR/CR 827 2 27-11824  ## 7 375 T LOX TE MAG STA 807 3 10 09 150 1056 DBF 85.10 CR/CR 866 2 2 27-11824  ## 7 377 T LOX TA MAG STA 807 3 10 09 150 1056 DBF 85.10 CR/CR 866 2 2 27-11824  ## 7 377 T LOX TAM ME INLET 1 11 1 500 1060 DBF 85.10 CR/CR 867 2 3 11 3 10-11824  ## 7 377 T LOX TAM ME INLET 1 11 1 500 1060 DBF 85.10 CR/CR 867 2 3 11 3 21 11824  ## 7 775 T LOX TAM ME MELT 1 11 1 500 1060 DBF 85.10 CR/CR 867 2 3 11 3 2 3 11 3 11 3 11 3 11 3 11 3	F 244 P 8 1450	HE BOTTLES HI 1	12 53 D 3500 P	1A 105 SLO	7 01728 5 40	665 1187 6 F	27-12643
### 115 Y LO2 PRESS REG INLT 1 11 5 H200 280 DOF SLO 7 01804 3 R307 1299 W 27-11802  ### 144 LO2 PRESS ORFC IN 1 11:11 0 500 DOF SLO 7 01804 3 144 1221 3 P 27-11822  ### 145 LO2 PRESS ORFC IN 1 11:11 0 500 DOF SLO 7 01804 3 144 1221 3 P 27-11822  ### 145 LO2 PRESS ORFC IN 1 11:11 0 500 DOF SLO 7 01804 3 144 1221 3 P 27-11822  ### 145 LO2 RE LAG STA 60! 3 11:35 150 1050 DOF SLO CR/CH 501 LEZ 19 27-11824  ### 145 LO2 RE LAG STA 60! 3 11:35 150 1050 DOF SLO CR/CH 501 LEZ 1 P 27-11824  ### 145 LO2 RE LAG STA 60! 3 11:3 150 1050 DOF SLO CR/CH 627 L P 27-11824  ### 145 LO2 RE LAG STA 604 3 10:47 150 1050 DOF SLO CR/CH 647 L P 27-11824  ### 145 LO2 RE LAG STA 604 3 10:47 150 1050 DOF SLO CR/CH 647 L P 27-11824  ### 145 LO2 RE LAG STA 604 3 11:31 1500 1060 DOF SLO CR/CH 647 L P 27-11824  ### 145 LO2 RE LAG STA 600 3 11:31 150 1050 DOF SE SLO CR/CH 647 L P 27-11824  ### 145 LO2 RE LAG STA 600 3 11:31 150 800 DOF SLO CR/CH 647 L P 27-11824  ### 145 LO2 RE LAG STA 600 3 11:31 150 1050 DOF SE SLO CR/CH 647 L P 27-11824  ### 145 LO2 RE LAG STA 600 3 11:31 150 1050 DOF SE SLO CR/CH 70:00 P 27-11824  ### 145 LO2 RE LAG STA 600 3 11:31 150 1050 DOF SE SLO CR/CH 70:00 P 27-11824  ### 145 LO2 RE LAG STA 600 3 11:31 150 1050 DOF SE SLO CR/CH 70:00 P 27-11824  ### 145 LO2 RE LAG STA 600 3 11:31 150 1050 DOF SE SLO CR/CH 70:00 P 27-11824  ### 145 LO2 RE LAG STA 700 3:10:31 150 1050 DOF SE SLO CR/CH 70:00 P 27-11824  ### 145 LO2 RE LAG STA 700 3:10:31 150 1050 DOF SE SLO CR/CH 70:00 P 27-11824  ### 145 LO2 RE LAG STA 700 3:10:31 150 1050 DOF SE SLO CR/CH 70:00 P 27-11824  ### 145 LO2 RE LAG STA 700 3:10:31 150 1050 DOF SE SLO CR/CH 70:00 P 27-11824  ### 145 LO2 RE LAG STA 700 3:10:31 150 1050 DOF SE SLO CR/CH 70:00 P 27-11824  ### 145 LO2 RE LAG STA 700 3:10:31 150 1050 DOF SE SLO CR/CH 70:00 P 27-11824  ### 145 LO2 RE LAG STA 700 3:10:31 150 1050 DOF SE SLO CR/CH 70:00 P 27-11824  ### 145 LO2 RE LAG STA 700 3:10:31 150 1050 DOF SE SLO CR/CH 70:00 P 27-11824  ### 145 LO2 RE LAG STA 700 3:10:31 150 1050 DOF SE SLO CR/CH 70:00 P 27-11	A F 17 T FUEL I	PRESS ORFC IN 1	11.45 0 500 5	67 12 SLO	7 01484 3		
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#### CONVAIR-ASTRONAUTICS

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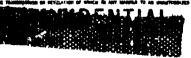
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**CONVAIR-ASTRONAUTICS** 

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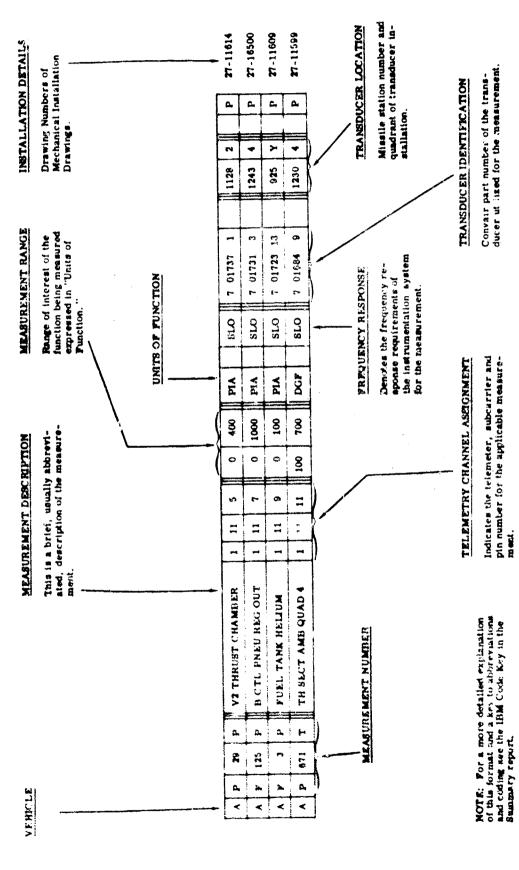
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# MISSILE INSTRUMENTATION BY CHANNEL

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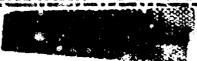
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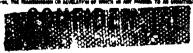


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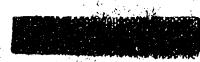
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MISSILE INSTRUMENTATION LOG SHEET
REPORT NO. AEC-27-099-18 DATE 16 MAR 61

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## CONVAIR-ASTRONAUTICS

REPORT NO. AZC-27-059-18

SECTION 9

16 MARCH 1981

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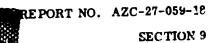
SECTION 9

16 MARCH 1961

### **CONVAIR-ASTRONAUTICS**

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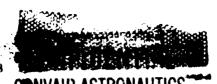


## CONVAIR-ASTRONAUTICS

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SECTION 9

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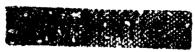
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SECTION 9

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## CONVAIR-ASTRONAUTICS

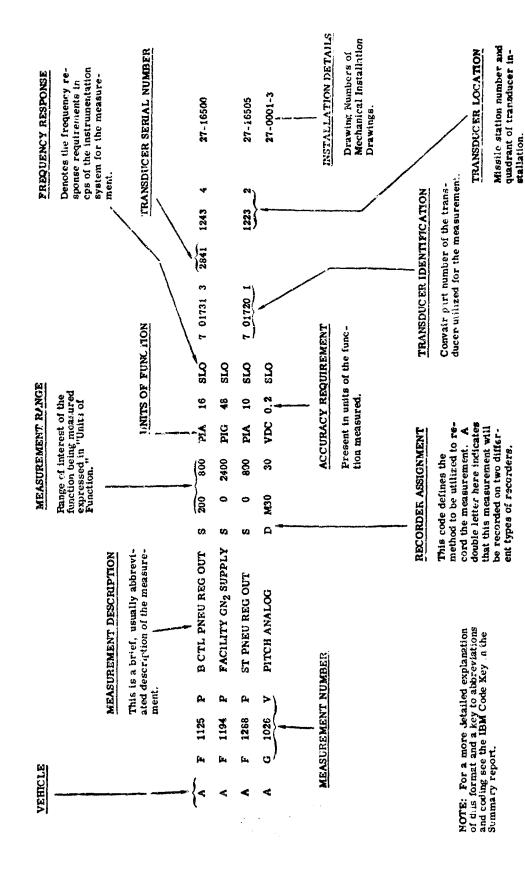
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# SECTION 10

# LANDLINF INSTRUMENTATION

The Landline Instrumentation presented in this section contains the latest available characteristics of the individual measurements. In addition the type of recordings indicated.





SECTION 10

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## CONVAIR-ASTRONAUTICS

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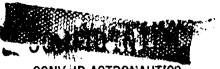


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